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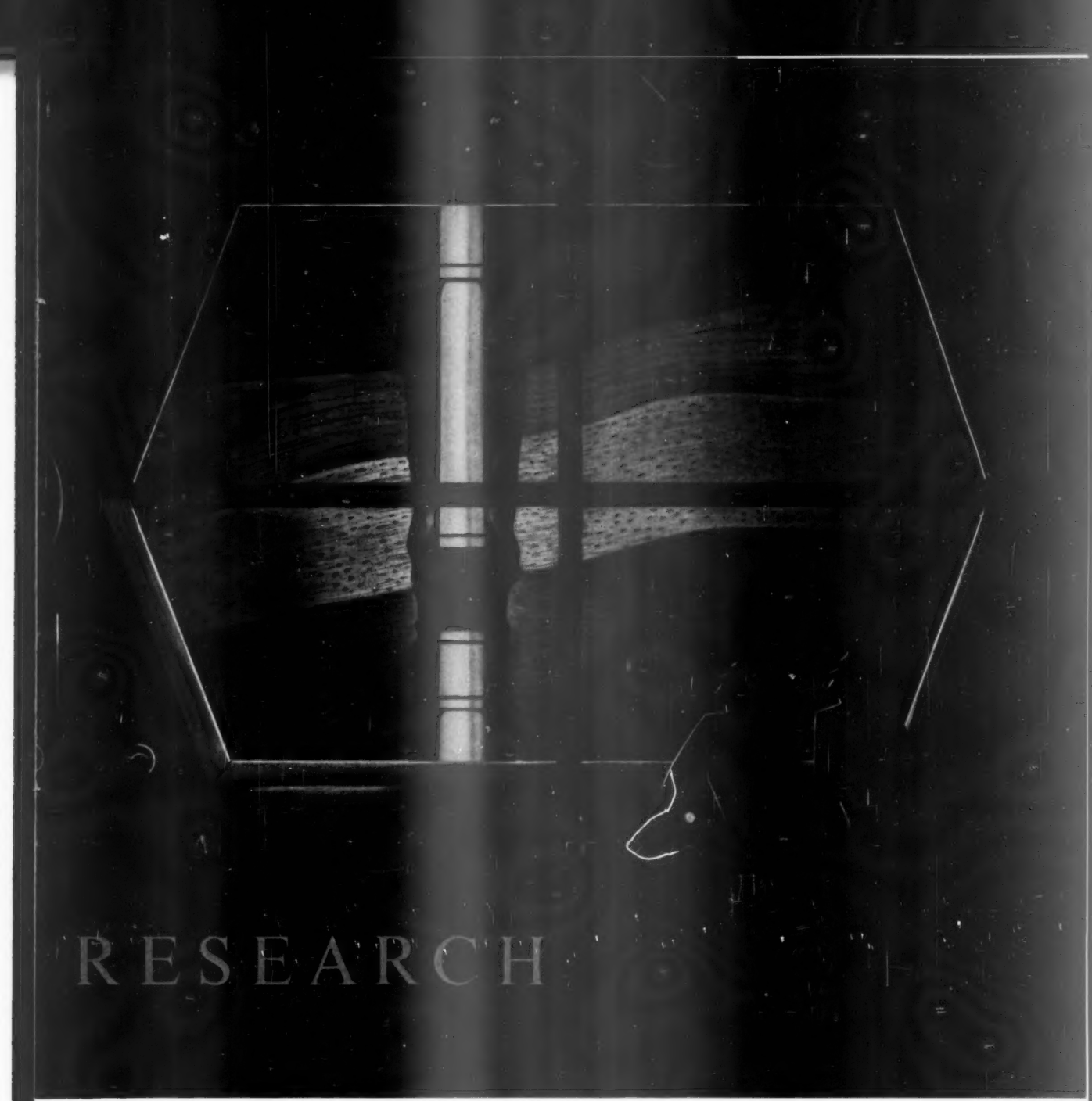

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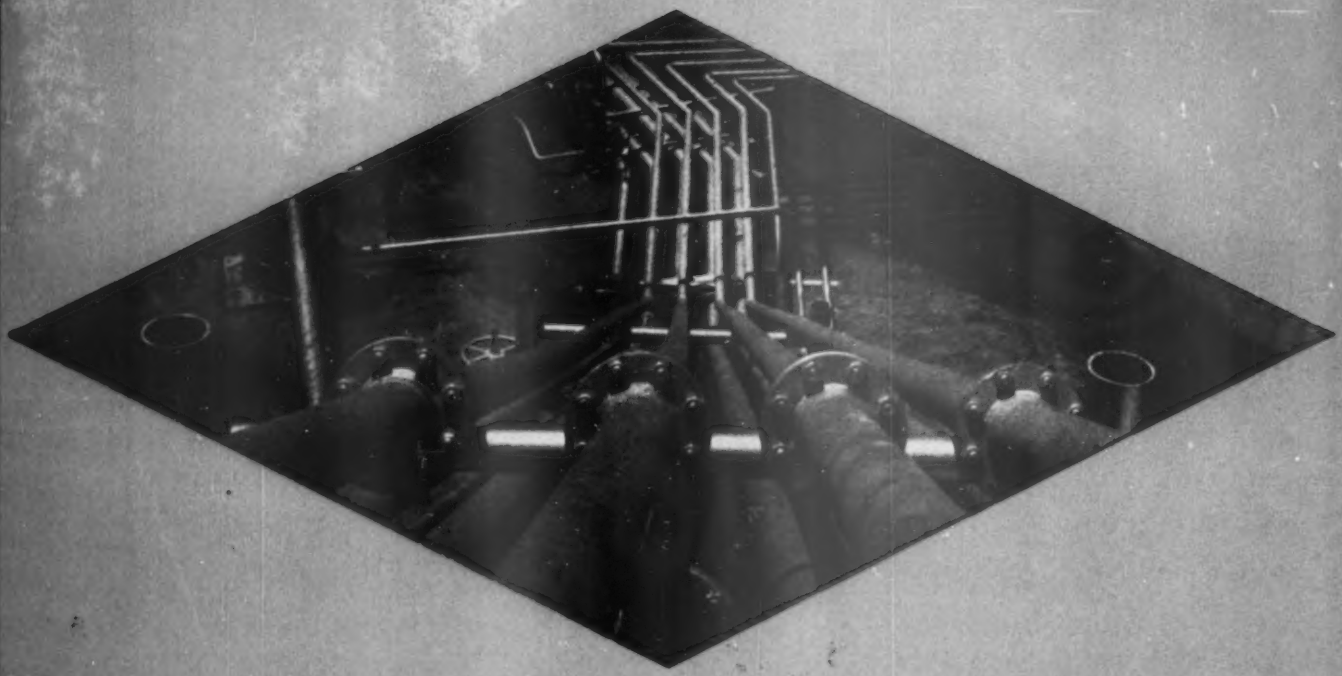

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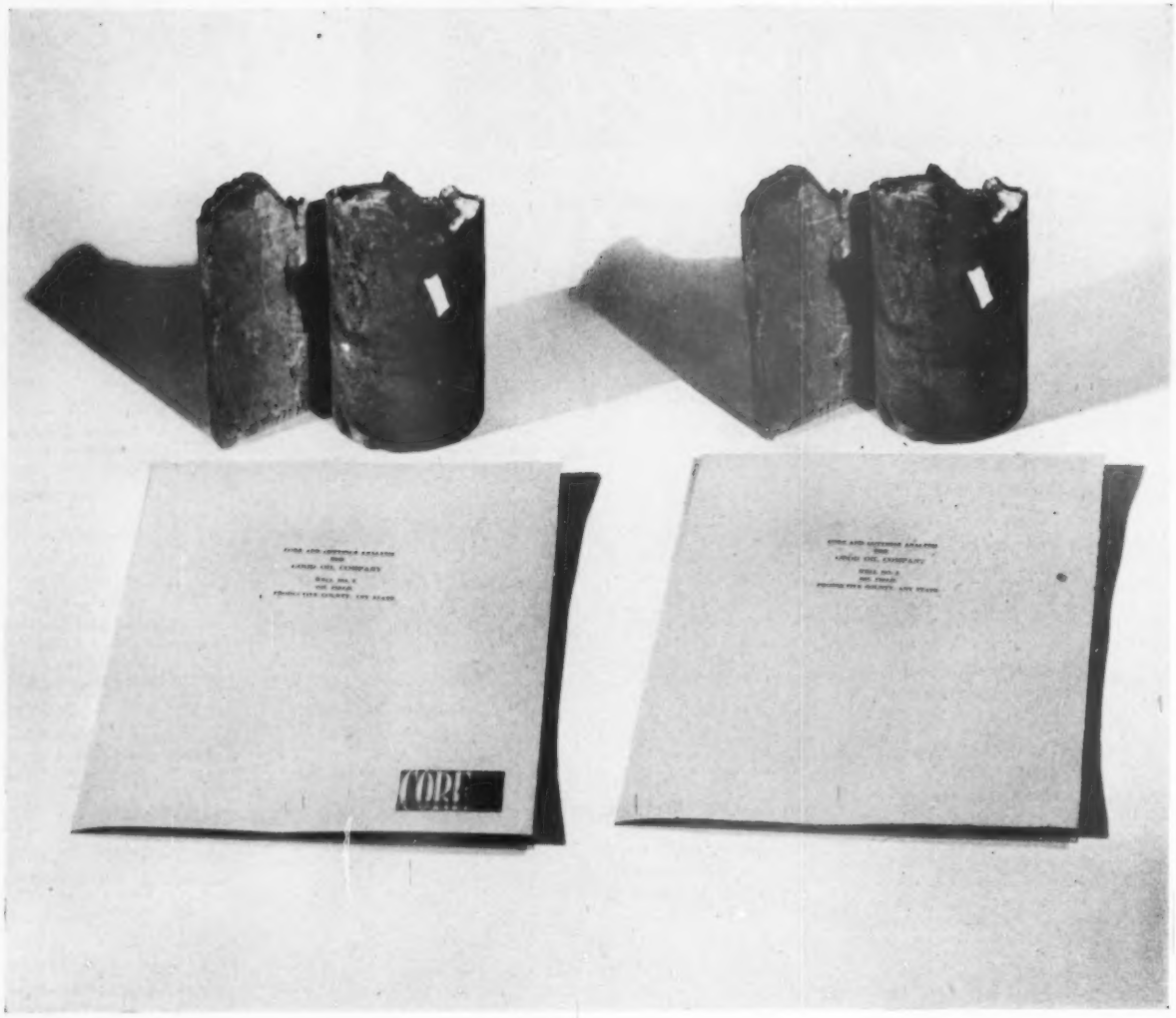

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PETROLEUM RESERVOIR ENGINEERING

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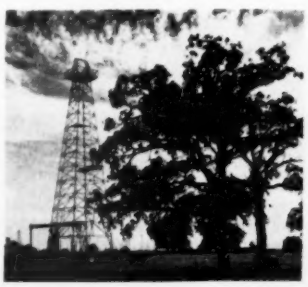
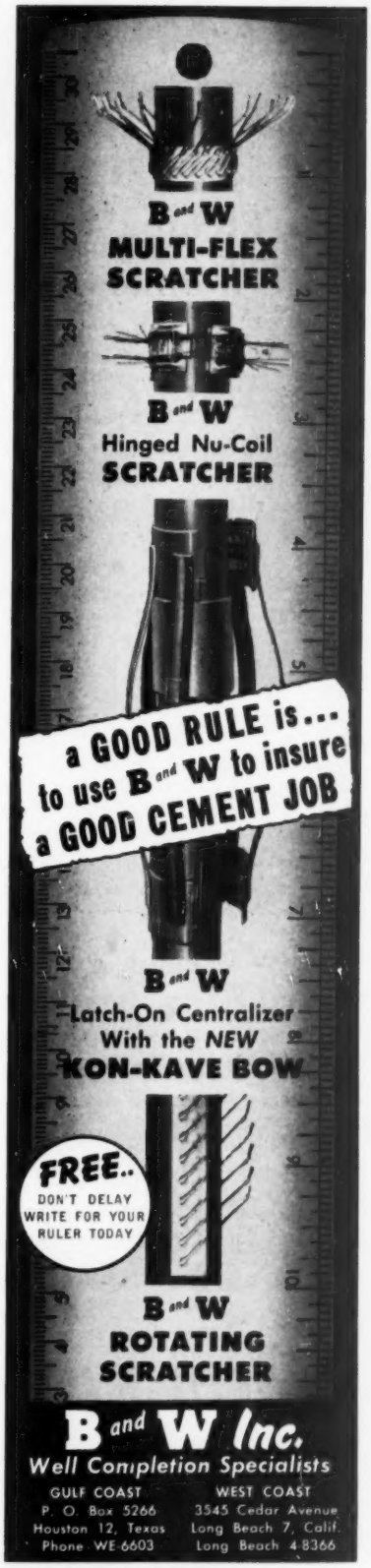


This Month's Cover

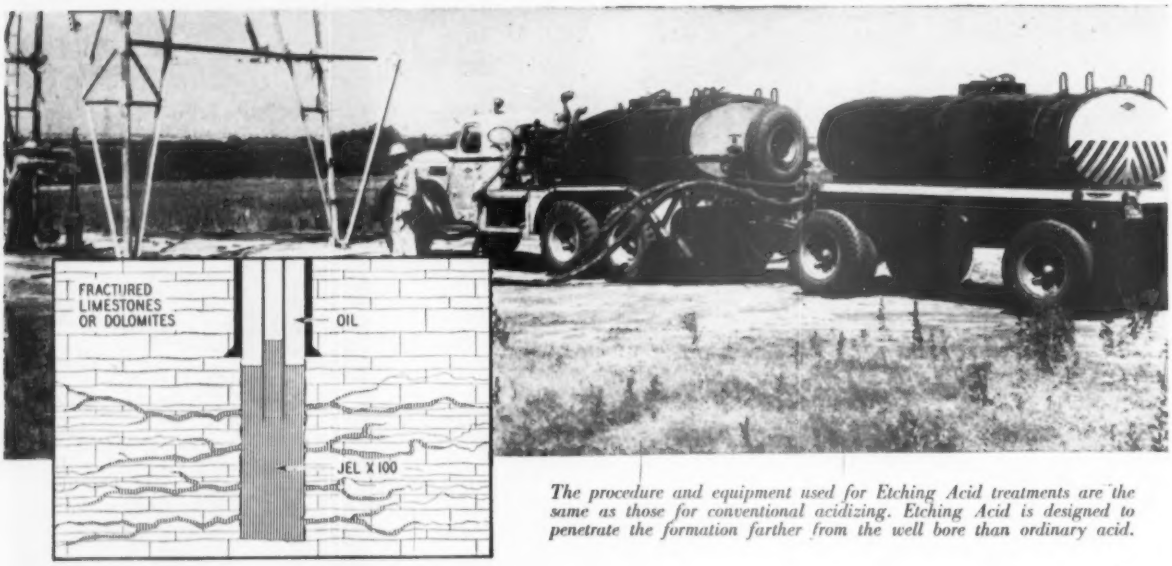
Cattle graze peacefully near a pumping well in the Raccoon Bend oil field in Austin County, Tex., creating a common scene in the oil country. Little indication is given as to the value of the oil property which lies thousands of feet below this typical site. For an insight on how properties such as this are valuated, see the four articles beginning on Page 9.

—Photo by Humble Oil and Refining Co.



ETCHING ACID GAVE RESULTS WHERE REGULAR ACID FAILED

Etching Acid increased production 25 BOPD after ordinary acid treatment failed to boost output



The procedure and equipment used for Etching Acid treatments are the same as those for conventional acidizing. Etching Acid is designed to penetrate the formation farther from the well bore than ordinary acid.

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News Briefs

The National Science Foundation has entered into a contract with the Slavic Language Department of Columbia University to translate approximately 1,000 pages of current Russian research reports in physics during the coming year. The project is part of a larger program designed to make it easier for American scientists to keep informed of current scientific developments abroad. A file will also be compiled of new or unusual Russian terms in physics and related sciences as the basis for an improved Russian-English scientific glossary. The first group of translations will include physics reports from the January, 1953, issues of *Doklady Akademii Nauk SSSR*, (Reports of the Academy of Science of the USSR).

* * *

Recent experimental work has resulted in comprehensive data on the viscosity and density of more than 40 lubricating fluids at temperatures from 32° F to 425° F and at pressures up to 150,000 psi. These new data are presented in two volumes entitled "Pressure-Viscosity Report" issued by the Research Committee on Lubrication of The American Society of Mechanical Engineers. Twenty-seven industrial concerns provided financial support for the project.

* * *

Preventive maintenance practices and techniques developed by the American chemical and petrochemical industries are being examined by a 27-man group from Western Europe. Included are technical and management representatives from European chemical and oil refining firms and staff members of research institutes, technical schools and universities. Harmful effects of corrosive substances on production equipment are being studied. The group has visited research laboratories and industrial plants in Boston, Jersey City and Harrison, N. J., and Wrightsville Beach, N. C.

* * *

Following geological, gravity, and seismic surveys in Sicily, D'Arcy Exploration Co., subsidiary of Anglo-Iranian, is to drill a test oil well in the Vittoria concession area. Arrangements are now being made for drilling by contractors to be started in the immediate future, The rig will be capable of reaching 8,000-10,000 ft. The company was granted permits to search for and produce oil around Ravanusa, Vittoria and Priolo in southern and eastern Sicily. Since the permit was issued in June, 1951, intensive exploratory work has been carried out.

* * *

A total of 2,825 rigs were active in oilfields of the United States and Canada in the last week of June, according to a report by the American Association of Oilwell Drilling Contractors. The figure compares with 2,757 rigs operating in the territory a month ago and 2,850 rigs during the comparable week in 1952.

* * *

John E. Rouse, vice-president in charge of operations and a member of the board of directors of Stanolind Oil and Gas Co., retired June 25 after 40 years of active service in the oil industry. His extensive experience in refining, gasoline plant operation and other phases of manufacturing throughout the Southwest, Middle West and Rocky Mountain areas has brought him wide recognition in the industry as an authority in these fields. During World War II he held important government posts with the Petroleum Administration for War and the Navy Department. He will locate in Denver, Colo.

* * *

Walter T. Wells, chairman of the board of directors of the Lane-Wells Co., was named the 15th winner of the Marston Medal for achievement in engineering at Iowa State College. The medal is awarded to an engineering alumnus of the college in recognition of achievement in engineering.

* * *

Operation of the Phillips Petroleum Co.'s private wire communications plant has been transferred to the Bell System. The cutover was held following approval by the Federal Communications Commission of the joint purchase of the private network by the Long Lines Dept. of AT&T, the General Telephone Co. of the Southwest and Southwestern Bell. Some 10,000 miles of communications circuits and 1,300 miles of pole line formerly owned by Phillips changed hands after more than 34 years of private operations by the oil company.

* * *

The financial position of the petroleum industry has been described as "excellent" by the Chase National Bank of New York. A 32-page booklet entitled "Financial Analysis of 30 Oil Companies" prepared by Frederick G. Couqueron of the Chase Petroleum Dept. points out that the industry has "chalked up impressive new records . . . and continued to set the pace for the amazing growth of the industry in the free world." The study is based on the combined operating and financial activities of 30 American petroleum enterprises, which together produced 58 per cent and processed 68 per cent of the total crude oil supply outside the iron curtain last year.

* * *

Stanolind Oil and Gas Co. has recently issued uniform licenses to seven service companies to carry out fracturing processes for increasing well production. The processes, developed by personnel in Stanolind's research and producing departments, basically involve fracturing tight formations to permit greater oil production. This is done by pumping a low-penetrating liquid into the well and building up pressures on the liquid until the formation fractures. Later, the fracturing substance thins so that it will flow back into the well with the first production. Propping agents are used, thus permitting the maximum flow of oil into the well bore. Licenses will be granted other service companies within a short time.

* * *

A publication on the geology and activities of the Uinta Basin in northeastern Utah and a book on asphalts and asphaltic materials has been published by the Colorado School of Mines. A. M. Current, geologist for the Carter Oil Co. is author of "A Review of the Geology and Activities in the Uinta Basin." He discusses the various oil-producing fields and the geology and surface indications of oil and other hydrocarbons found in the region.

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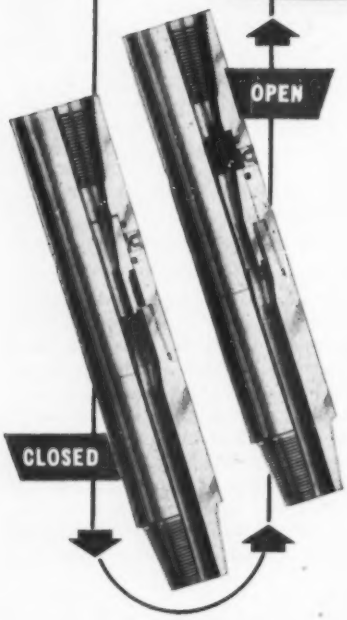

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FORMATION AND CASING TESTING — JOHNSTON

Valuation of Natural Gas Property

By
Ralph E. Davis
Consultant, Houston, Tex.
and
Dr. Eugene A. Stephenson
Professor Emeritus, University of Kansas

The appraisal of natural gas properties is a complex problem affected by many non-engineering factors. Attention will be brought here to the more important matters that influence value of such properties, such as the necessity of competent estimates of reserves, availability of the products and of market outlets, the expected rate of recovery, the anticipated prices of products and future costs, the effect of the graduated income tax on profits which lead to greater value of a property to one owner than to another, and other items. To a degree, in each appraisal the problems are unique in that the approach must be suited to the particular case.

During the past 30 years and more, many engineers and geologists have accumulated considerable experience in the problems of evaluating properties capable of producing oil and natural gas. An extensive literature has developed outlining the principles and methods that govern appraisals. Emphasis is placed herein on the importance of careful analysis of the various factors which should lead to a determination of value, and to point out the inadequacy of rather common engineering appraisals that frequently have little relation to what has been termed "fair market value." In a Delaware court some years ago an engineer admitted freely on cross-examination that his appraisal was "an engineering valuation — not a determination of the fair market value." Such so-called "engineering appraisals" are perhaps interesting, and occasionally may be of some use, but must not be considered of fair value.

During the past few years the effect of the graduated income tax has become especially important in the appraisal of properties yielding income, and promises to continue to be so far a long time. This tax places some corporations in the 52 per cent bracket and subjects individuals to rates that may be as high as 85 to 90 per cent. To those institutions whose income is not taxed, a property can be worth two or three times as much as it may be to the individual in a high tax bracket. Hence it is necessary to consider and determine the fair value applicable to the tax situation of the prospective purchaser. Government regulation of the buying and selling price of gas also influences value. Examples are known where a single property is owned in part by a gas company whose earnings are regulated to, say, 6 per cent and the other co-owner is able to sell his gas even to his regulated partner at a price far above that permitted the latter for his own gas. The result is that one part of the property has a fair value in the market place of several times that of the regulated share. Appraisals are made for business purposes and although it would seem illogical to find at a given time substantially different values for a particular property, depending upon the business purpose, it is clear that these factors just mentioned have produced precisely that situation.

What an Appraisal Is

An appraisal is an estimate of the value of a property. It requires a study made by a person with knowledge of the type of property to be appraised. The elements which are important in evaluations of real property are: annual production, expected prices and costs, risks, physical deterioration and exhaustion of productivity. In the case of oil and natural gas property, their appraisal is a relatively recent development of the older art of appraising mining property. In both cases the fundamental requirement is an estimate of the ultimate production, the timing of this production, its costs and income. The determination of these elements is based upon geology and engineering.

Some Aspects of "Value"

An appraisal results in a dollar value of the property in question. What is this value? The appraised value may be above or below the value of the property to its owner, or to a particular prospective purchaser. It will probably differ from the value as indicated by a recent sale for similar property. The careful evaluator does not necessarily underwrite the judgment of the principals who make a transaction. Rather, the appraised value is an expression in dollars of the interplay of all the principal physical, economic and perhaps political forces that affect the property now and perhaps in the future.

An appraisal is a guide to business decisions, not their determinant. The buyer, the seller, the lender, the borrower, each views a property differently, because each one must consider it in relation to his particular tax position.

Property may have value for a number of reasons. "Use value" is a quality of consumer goods, such as houses and shoes. "Investment value" is based on earning power in the form of future annual incomes which the property is expected to produce. For example, the appraisal of a proved gas property yields an investment evaluation. "Speculative value" arises because of expected capital appreciation over present value. Acreage which is probable or prospective for mineral production has speculative value.

A fundamental economic difference is apparent between proved and unproved acreage. The appraiser's estimate of the investment value of proved acreage is a process that is reducible largely to measurable quantities. The steps in the process, other than judgment, are explicit, objective and can be substantially verified. The methods of valuing unproved acreage are quite different. Hence, a clear distinction must be drawn between what is proved and unproved, and the investment value ascribed to the proved acreage only.

This distinction is particularly important under current business conditions. Our economy operates under a burden of

income taxes which extracts a toll from every significant segment of productive activity, and influences virtually every major business transaction. The relative tax position of different individuals and corporations may be the primary consideration that determines the desirability of an investment either in proved properties, or in unproved lands which may or may not yield a profitable return after expensive exploration costs have been incurred.

Unproved acreage has value because prospectors may test it with the drill and discover oil or gas. The valuation ought to depend largely on the degree of probability that the property contains hydrocarbons recoverable in commercial quantities. Thus the distinction between probable and prospective is a difference of degree rather than of kind.

The Classification of Acreage

The classification of unproved property is primarily a matter of informed geological discretion, and depends largely on the known facts in each particular case. If the area is favorable for the accumulation of hydrocarbons, the acreage may be classified as prospective. If the property in question is favorably situated on a known productive structure it may be classified as probable

In 1909, Herbert Hoover published a classic treatise entitled *Principles of Mining*[1] which is still useful for analysis of some of the basic principles and problems of mineral valuation. Much of his discussion, modified to fit the specific case, can be profitably applied to present day appraisals of oil and gas property. This is particularly true of his classification of ore reserves. Because of his emphasis on the importance of carefully chosen words in order to avoid ambiguous definitions, his classifications of reserves may well be quoted here:

"Proved Ore: Ore where there is practically no risk of failure of continuity.

Probable Ore: Ore where there is some risk, yet warrantable justification for assumption of continuity.

Prospective Ore: Ore which cannot be included in the above classes, nor definitely known or stated in any terms of tonnage."

Hoover said: "The old terms 'ore in sight' and 'profit in sight' have been of late years subject to much malediction on the part of engineers because these expressions have been so badly abused by the charlatans of mining in attempts to cover the flights of their imaginations. A large part of Volume X of the *Institution of Mining and Metallurgy* has been devoted to heaping infamy on these terms, yet not only have they preserved their place in professional nomenclature, but nothing has been found to supersede them."

One may wonder why reference is made to so old a treatise, written to discuss valuation of certain metallic minerals. It is because of a desire to emphasize the fact that some of the greatest difficulties met today in making dependable valuations of oil and gas properties are of the same kind that were common a half century ago in the valuation of metal mines. In oil and gas appraisal work, no sharply defined standards have been established for the common terms "proved," probable" and "prospective" reserves. Reliance must be placed on the prudence of the appraiser.

Valuation of Unproved Acreage

In valuing probable and prospective acreage, the appraiser must consider a number of factors. The weight to be given each factor is a matter of discretion. The price at which comparable acreage is selling is one possible guide. But market forces are frequently fickle. Enthusiasm sometimes triumphs over judgment, and probable acreage may be selling at prices unwarranted by the available information. At other times, the reverse may be true. The experienced evaluator is able to assess the reliability of "going prices" as a measure of value.

Economics of future development and availability of markets are often important elements in the value of unproved acreage. For example, extensive areas of the Hugoton Field were highly probable in the early 1930's, but development costs were so great relative to the available gas markets that the value of this acreage was low.

Frequently the available geological information enables the geologist to estimate roughly the magnitude of the potential reserves. And this knowledge may guide his decision as to whether or not it will be feasible to develop a commercial property if gas is discovered.

The evaluator considers the geologic and economic data that suggest the order of magnitude of possible discoveries. He gives weight to the timing, the costs of development, and market prices, to arrive at the order of magnitude of the value of the unproved acreage. Finally it should be emphasized that in valuations of unproved lands, the appraiser must recognize that the risk element controls.

Within the past decade, income tax rates have created a new phenomenon known as "tax money." The value of unproved acreage may be influenced by the tax-dollar position of prospective purchasers and sellers. Hence the relationship between the risks of unproved properties and the tax position of those who commonly explore them, has become an important factor in the valuation of such acreage.

Appraisal of Proved Gas Properties

Natural gas reserves are frequently classified according to their physical position relative to petroleum, although many enormous gas accumulations have no association with oil. Gas also occurs associated with oil both as a gas cap above the oil and dissolved therein. In general, the gas in the reservoirs that do not contain oil consists of the lighter hydrocarbons, predominantly methane and ethane. Larger proportions of the heavier hydrocarbons are present in the gas associated with oil, and these are also important constituents of the deep, high pressure accumulations known as condensate reservoirs or fields. Gas found in solution with oil will be produced at rates dictated by the engineering and economics of oil production and ordinarily this will be true also of gas cap gas. Gas from a condensate type reservoir may, and probably will be returned to the reservoir, if economic conditions justify, after the liquids have been removed, in order to maintain the underground pressure, and thus prevent possible loss of liquids through retrograde condensation. Associated gas is ordinarily valued as a by-product of the production of oil or condensate. Gas not associated with oil or with substantial amounts of lighter liquids is generally produced in accordance with market requirements for the gas.

Choosing the Method

Before monetary value can be placed on a proved gas property, it is necessary to determine the quantity of gas in place, how much of it is likely to be recovered, and at what annual rates. Several methods may be used to calculate these quantities,[2-9] but the principal ones are the volumetric method and the production-pressure history method. It should be emphasized that not infrequently the judgment exercised in making a proper selection of method is far more important than any refinements of method that subsequently may be made.

Volumetric Estimates

The volumetric estimate is the result of a calculation of the size of the reservoir and of the known gas-containing space within it. The calculation follows this sequence:

(a) The gross volume of reservoir rock containing gas is computed areally, in acres, with thickness expressed in feet.

[1]References at end of paper.

and the size of the reservoir stated in units of acre feet, or cubic feet. Geological information as to the magnitude of the structure and the limits of gas accumulation within it is needed. Structural and isopachous maps of the reservoir must be prepared based upon geological logs of the formation penetrated, electrical logs and core analyses. The results of tests of the sand made to determine its productivity are also generally required. Some sections of the reservoir rock may be eliminated because porosity or permeability are too low, or because too large a percentage of interstitial water is present. The remaining reservoir rock is considered to be commercially producible, and is classified as the pay thickness, measured vertically in feet.

(b) The gross volume of the pay, measured horizontally in acres and vertically in feet, has varying degrees of porosity in its different parts. The average porosity of the pay is ascertained from labortary information. The acre feet of pay are converted to cubic feet and multiplied by the average porosity of the pay section to yield a product that represents the total volume or space containing reservoir fluids, expressed in cubic feet.

(c) Oil and gas reservoirs generally contain water, which adheres to the sedimentary grains in quantities primarily related to the physical and chemical character of the sediment. Based upon physical laws, it may be inferred that the interstitial water is less in gas than in oil reservoirs. Information regarding this point is meager. It is necessary to deduct the connate or interstitial water from the volume of total pore space before arriving at the net volume of gas-containing space. The total quantity of gas contained in this pore space or reservoir is directly related to the reservoir pressure. Corrections are made for temperature and deviation from the "ideal gas" behavior before arriving at the quantity which the reservoir contains.

The customary volumetric formula used in estimating gas in place may be expressed as follows:

$$V = 43{,}560 \times A \times S \times P \times (1-C) \times \frac{P_r}{P_{mb}} \times \frac{T_{mb}}{T_r} \times \frac{1}{Z}$$

Where:

V = the volume of gas in the reservoir, in cu ft, at pressure P_{mb} and temperature T_{mb}.
43,560 = the number of sq ft per acre.
A = the proven area, in acres.
S = the average net effective pay thickness, in ft.
P = the porosity of the pay usually expressed in per cent.
C = the connate water content of the pay usually expressed in per cent.
P_r = the reservoir pressure psia.
P_{mb} = the pressure measuring base in psia.
T_r = the reservoir temperature in degrees Rankine (Fahrenheit plus 460°).
T_{mb} = the temperature measuring base in degrees Rankine.
Z = the deviation of the gas from ideal gas behavior.

The foregoing discussion indicates the fundamental importance of geological knowledge in making estimates of gas in place by the volumetric method. Virtually every significant step taken in the calculation of the space within which gas is confined requires an act of judgment based on geological and engineering evidence. Errors in judgment, as well as in data, can result in grossly inaccurate estimates.

The role of the geologist in oil and gas discovery has been greatly enhanced by geophysical methods for the delineation of both subsurface structure and stratigraphy. Interpretation of the geophysical data requires a more intensive type of training and broad geological experience. At one time the geologist would not go far astray in the portraval of a subsurface structure if he assumed approximate similarity to the attitude of the rocks observed at the surface. The increased depth of modern wells, the numerous unconformities, the multiplicity of sands, their lenticularity and the frequency of faults make it imperative more than ever that he visualize subsurface features in three dimensions. The structural complexity of many producing fields is comparable to the intricate system of mineral veins that distinguish many mining districts. But in mines the ramifications of underground workings reveal to the eye the intersection of one vein with another, as well as the several generations of faults and their chronological sequence. In the case of hydrocarbon reservoirs, nature's blankets of successive sedimentary rocks have reduced such visibility to zero, and reliance must be placed upon material obtained through the use of geological and geophysical tools. However, remarkable skills have been developed for translation into the essential engineering terms the information available from seismic studies, cores, electric logs, bottom hole samples and pressure bombs, as to position, extent, and peculiarity of the various strata, together with data relative to the physical properties of their fluid contents. Computation of recoverable reserves in these deep reservoirs depends upon these geological and engineering facts, and also demands familiarity with their effect upon the movement of the reservoir fluids.

(d) Only a portion of the gas contained in the reservoir will ultimately be produced. It is necessary to determine a recovery factor, or percentage of the gas which will likely be produced during the economic life of the property. In the final analysis, the recovery factor is estimated after consideration of the net interplay of physical, regulatory and economic forces, many of which may be known imperfectly.

A study of many depleted or nearly depleted fields[10] indicates that under average conditions about 85 per cent of the total gas in place will be recovered. The amount in any case is dependent upon an interplay of many factors, of which the permeability of the reservoir rock is a major one. The recovery may reasonably be estimated as low as 50 per cent to 60 per cent or higher than 95 per cent. In each case the suitable recovery factor must be determined.

Production Performance Estimates

Long experience with producing wells has demonstrated that there may be a considerable degree of uniformity in their life performance. In the case of volumetrically controlled reservoirs, curves can be constructed that describe the production history of wells; these can be extrapolated to forecast the future production. Even though fields or wells rarely produce at uniform rates, an experienced appraiser can evaluate the degree of dependabiilty of various estimates that are based on past production.

These estimates take several forms, but they rest on observed facts. Production per unit of time may decline with the age of the well. The annual rate of production may therefore be plotted against time, and the resulting curve extended to measure annual rates in future years. For ease in extrapolation, it may be desirable in certain instances to plot the production decline curve on some type of logarithmic paper. If the production rates of the wells fluctuate widely with market requirements or proration controls, past performance may be of little use as a guide to the future.

Estimates based on production performance are fundamentally dependent on Boyle's law (suitably modified for deviations therefrom), according to which the quantity of gas contained in a reservoir of fixed volume is directly related to the pressure, at constant temperature. As the gas reserve is produced, the pressure declines. The estimator needs to know the average shut-in wellhead pressure, or the bottom hole pressure, and the cumulative production as of various dates.

Average pressure plotted against cumulative production on cartesian coordinate paper will yield a reasonably straight line descending to the right. It is sometimes convenient to divide the pressures by Z, the deviation factor, and then use the corrected or modified pressures[2] as one of the variables which is plotted against cumulative production to give a straight line on cartesian coordinate paper. This line can be extended to some assumed abandonment pressure, in order to measure the total estimated ultimate production. The difference between the ultimate and the past production, is the estimate of the remaining reserves that will be recovered. It should be noted that this method does not indicate the annual rate at which the gas will be produced. Furthermore, since it assumes production from a reservoir of constant volume, it is not applicable to a gas field actuated by an active water-drive.

The matter of water-drive requires special comment. Sometimes in the early history of a field the data may indicate water-drive. The evaluator may not be certain that an estimate based on pressure decline is a wholly trustworthy guide to future production; it may need correction to allow for water encroachment in the reservoir. At other times, the relation between gas production and pressure decline may be considered a reliable guide, until new evidence indicates that pressures are abnormally maintained by water-drive. In the first instance, reserves could be under- stimated if no water-drive exists; in the second, over-estimated before discovery that the reservoir is contracting in volume. The curve is affected by the production rate, which is a function of the pressure differential. Reservoir performance may very between 100 per cent volumetric control and 100 per cent hydraulic control.

Production performance estimates are extensively used in valuing fields which meet particular conditions. Since they are based on history of production and the resulting cumulative data, they cannot be used in newly developed properties. Their accuracy increases with the age of the field or wells. Since such estimates are based on well and reservoir performance history, they are often limited in usefulness to the developed portions of a field or of a particular property.

Market Availability

Gas moves only in pipe lines. Accordingly the nation's gas reserves require their own individual transportation systems in order to reach their market. The owner of a gas property can realize no income from it unless his gas reserves are tied by pipe line to a consumer who may be located in the field itself or at a more distant market. His reserves must be sufficient to justify the cost of building, maintaining, operating and amortizing the transportation system, at least in part, if they are to earn an income.

Neither can natural gas be stored economically by most consumers. The gas consumer does not lay up a supply of the fuel, but takes it from the seller as his needs require, and uses it immediately upon receipt. At any point of time, the consumer is utterly dependent upon a particular supplier. In order to protect himself, he seeks contractual assurance of a continuous supply.

Gas Contracts

Gas contracts not only determine the prices to be paid; they also impose on the seller certain conditions as to quality and delivery which may in effect require that he develop the property according to a pattern implicit in the sales agreement. Accordingly in a valuation, all the provisions of the contract must be considered.

Availability of Gas

Availability is the capacity of a property to produce under certain operating conditions. It depends upon the physical character of the reservoir, well completion methods, the development in the field, and the method of operating the property involved and those adjacent to it. It is affected by physical laws governing the flow of gas through the reservoir rock to the well, through the tubing, the gathering lines, and so on into the purchaser's line.

These physical conditions of availability must be considered in the light of the gas sales contract. They dictate that enough wells be drilled initially to supply the daily volumes specified in the contract. As a property is produced, the reservoir pressure declines, and it becomes necessary either to drill additional wells or to install compressors or both. The contract determines what the property, under expected conditions, must do, while natural forces determine in part what it can do. In order to win the income, the operator must incur development costs appropriate to the conditions imposed by nature and the contract requirements. The evaluator must make estimates of the timing and the costs of a development program before he can estimate the expected future annual incomes.

Furthermore, the evaluator must consider the effects upon availability that stem from regulation of production by public authorities. The gas flow of many properties is restricted by proration orders imposed for conservation purposes, or for protection of the rights of all owners in a common pool. Occasional instances are known where state-imposed allowables have superseded contract volumes, and as a result, altered the development pattern, the annual production rate and the value of the property. While the evaluator may be unable to predict the imposition or continuation of proration, he must consider it either as a fact or as a possibility.

The Calculation of Income—Gross Revenues

After an estimate of the recoverable gas reserves, the by-products (if any), and the annual rates at which they will be produced, the appraiser calculates the owner's annual net working interest after royalty. This involves assumptions about future prices. Ordinarily it is safe to assume future prices that are in line with those currently offered in the same area. From the estimates of future production and prices, calculations of future annual gross incomes may be made. From these incomes, proper cost and expense deductions should be made to estimate the net annual taxable income and the net annual cash income.

Costs or Expenses

The pattern of development of a property is dictated largely by contract requirements, considered in relation to physical characteristics. With this in mind, the appraiser must prepare a reasonable development program. This involves estimates not only of the number of wells and the amount of compression, but the timing of development. It should be noted that, to a degree, compression is a substitute for additional wells.

Cost estimates depend upon assumptions about future prices of labor, materials and other items. If the present scale of gas prices is used in determining future revenues, it is generally reasonable to estimate future costs on the basis of current wages, materials, prices and taxes. Over the life of the property appraised, costs and revenues will probably fluctuate in the same direction, though perhaps not always at the same time.

Costs must be viewed in another way. Cash outlays reduce the actual dollars which accrue to the owner in each income period, but do not represent the total costs of production. Since income tax payments are cash outlays, it is necessary to compute the net annual taxable incomes in order to determine expected income tax costs. Thus two calculations must be made, one of net cash income subject to tax, another of net annual profits after all cash outlays. In order to determine

the taxable income, the appraiser must act in accordance with the appropriate Federal regulations.

Depletion Allowance

An investment in a natural gas property is an investment in a wasting asset. When production ceases, the property has little or no salvage value. Accordingly, the investor expects the property to return to him his capital outlay as well as pay him a return on that investment. The rate at which the investor recoups his capital is dependent not only on the gross earning power of the property, but on the methods of depreciation and depletion permitted by the income tax laws. These provisions are found in the laws of both the United States and Canada, with but slight differences between the two.

In the income tax laws of this nation, depreciation charges are considered operating costs and hence are tax free. It has been the theory that productive enterprises should have some incentive to replace physical assets as they wear out, and thus maintain the productive capacity of the economy. With oil and gas, their replacement involves great uncertainty and risk. The real costs of replacement rise because progressive depletion makes it necessary to search deeper and in less accessible areas. Finally, the historical costs of finding productive properties furnish little guide to such costs in the future. The operator has no assurance that the expenditure on exploration of a sum equal to the cost of a past discovery will add an equivalent quantity of new reserves to the national total.

The percentage deduction for depletion is a recognition of these facts. This permits the owner to deduct 27.5 per cent of the gross value of production after royalty (or 50 per cent of the net, whichever is smaller) from his net revenues before arriving at his taxable income. By another provision, the owner is permitted to charge intangible drilling costs to expense for the year in which the costs are incurred. These two features of the income tax law recognize the owner's investment in a dwindling asset, and are a substitute for the depreciation charges permitted to other industries for recovery of investment in replaceable productive assets, like factories or machinery. They serve as a powerful inducement to the operator to earmark revenue from the sale of hydrocarbons for reinvestment in the hazardous business of further search for oil and gas. They are a type of public policy which contributes mightily to the increase in the national inventory of energy resources.

Net Income Before Tax

The net annual income subject to tax is a residual after all allowed "costs" incident to production have been met. It is not "profit" in any abstract economic sense, but a value which must be calculated in accordance with the law. From the estimated annual gross revenues, deductions are made for operating costs including property taxes and management, and for intangible drilling expenses, if any. This yields a schedule of expected annual taxable incomes, from which the income tax costs may be computed.

Net Cash Revenue

In the discussion of costs, distinction was made between items which involve actual cash outlays and those which are accounting charges in an income period. The "net cash revenue" is the dollars remaining to the owner after all out-of-pocket payments for the year have been met, and after income tax. By examination of the "net cash revenues" and not net income one discovers the cash to be retained by the owner after all outlays have been made. Since these annual sums are computed without reference to depreciation or depletion allowances, it is to them that the owner must look for the return of his principal.

Income Tax Problems in Appraisals

The fair value of a proven property is related ultimately to the cash it is expected to yield after income tax. Hence future income taxes must be deducted from net cash revenues to arrive at the annual dollars estimated to be available to pay out the investment plus a reasonable return.

The income tax is all-pervasive, and affects the earning power and hence the value of proved gas properties. The estimation of income taxes in appraisal work may be complicated because different rates apply to different persons, but this does not alter the fact that the market views the tax as a cost to be borne by the property. The seller has his tax problem. Each of several purchasers has his tax problems. The appraiser has these problems to consider.

The impact of the graduated income tax at high rates is so violent that it distorts market forces and relationships which formerly were considered normal. The common definition of fair value should be modified somewhat as follows: "The fair market value of a property is the price at which a willing and informed owner would sell to a willing and informed buyer, with full consideration given to their relative tax positions."

The Pay-Out Period

The value of a property is in part related to the pay-out time. The longer it takes for the owner to recover his investment, the lower the value, if other things are equal. A property which will return the owner his investment in five years will have a higher relative value than one which will be produced at rates equivalent to a ten year pay-out, even though the reserves are about the same in both cases. Furthermore, a prospective purchaser would wish not only the return of his capital, but substantial expected income after the "pay-out" period.

Some Types of Valuation

Before concluding this discussion, it is probably desirable to distinguish sharply the engineer's appraisal from some other types of valuation. In the case of regulated gas utilities, the valuation is for the purpose of establishing rates. The theory of public utility regulation is that the utility should be permitted to charge prices which are fair. Fair prices are conceived to cover all costs (including income tax) and permit if possible a reasonable return to the owners. Price determination therefore requires decisions as to what should be included in the rate base, and what constitutes a fair return thereon. The rate base is a valuation of the property based not on what the property will earn, since that is the matter to be determined, but on what it cost originally or what it would cost to reproduce currently. Several of the large interstate gas companies owned producing gas properties when Federal regulation was introduced into the gas business in 1938. For rate making purposes, these gas reserves are valued on the basis of depreciated original cost, not in terms of current field values for gas. As a result, some of the nation's choicest gas reserves are valued at ridiculously low figures.

Secondly, distinction should be made between the engineer's valuation and that placed on property by the securities markets. While the value of equity stock is related to the value of the property, part of the value of gas and oil properties lies in the chance of capital gain through new discoveries. The stock market may very well place a much higher (or much lower) value on the probable and prospective acreage of a company than would a prudent engineer.

It is not expected that the engineer's estimate of the fair value of proved or unproved properties would agree with, or

(Continued on Page 7, Section 2)

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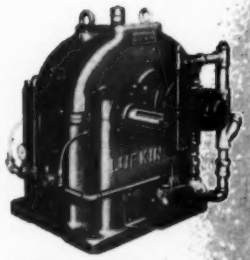

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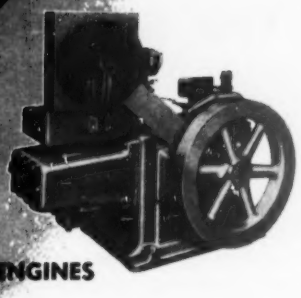

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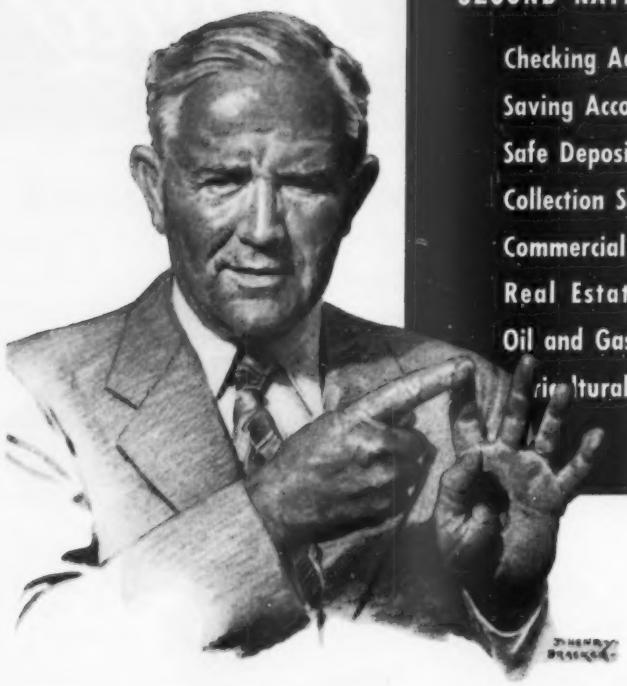

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Valuation of Oil Properties

By

Dean H. Sheldon
Consultant, South Pasadena, Calif.

INTRODUCTION

Those of the oil industry, who are concerned with the earning power of oil producing properties, visualize a valuation report as a rather stereotyped presentation of data in a form that engineers use to present the results of an analysical engineering appraisal. Specifically an engineering appraisal is an estimate of future recoverable oil and the cash profit to be derived from the production and sale of that oil. It should present with clarity the difference between factual material and the opinions formed from the analysis of that material. In presentation the engineer should keep in mind the purpose of the appraisal and the background of the people to whom the report is addressed.

FACTORS CONSIDERED

The fundamental features of an engineering appraisal for oil producing properties are:

The type of interest in oil production that is being appraised and the contents of the documents which create the interest.

The acquisition of data on the physical aspects of the oil reservoir and the income and expenses that are connected with the removal and marketing of the oil and its associated hydrocarbons and the use of such information to forecast the probable future earnings of the property.

There are many types of interest that may exist in a piece of oil producing land. There is a mineral interest, a landowner's interest, an overriding royalty interest, an operating or lessee interest, sometimes called the working interest, a carried working interest, and a participating interest.

Each has a distinctive character determined by the wording of the legal document or contracts which create and transfer its ownership from party to party. Careful consideration of all the terms of a lease and their effect on the earning power of an oil property from a lessor and lessee's point of view is not feasible. Nor is it proper to attempt a review of the effect many features of operating agreements and assignments may have on the worth of various interests in oil production. A brief examination of some of the terms commonly found in various contracts concerning oil properties might be of interest to engineers.

For example, the term of a lease is divided into two parts. The primary term is usually limited to a fixed number of months or years during which the lease may be maintained in good order without drilling operations. The secondary term covers the development and production of oil from the land. Many leases permit production operations "as long as oil is produced in commercial quantities." The right to drill, redrill, and deepen wells may be either for an indefinite period or a fixed term. There were many leases drawn during the 1920's in California that had a secondary term with a specific date upon which production and drilling rights terminate. With properties still producing oil at rates well above the economic limit at the time the lease terminates, the type of interest being appraised becomes doubly important. If it is an interest in the land and/or the minerals in place, its earning power may increase. If it is an interest in the lease only, it may enjoy no further income. The advantage in such a situation may rest with either the lessor or lessee. The abandonment clause may determine where leverage exists in negotiations for a new agreement.

Lands Not Fully Developed

Drilling requirements and quitclaim clauses may be of vital interest where producing lands, not fully developed, are being appraised. The drilling requirements set forth the spacing of the wells as agreed to between lessee and lessor. They often require that the number of acres under lease divided by the number of wells shall be equal to 5, 10, 20, 40 or more. Spacing requirements sometimes apply to each zone or formation. The lease terms on well spacing may apply only if a sufficient number of wells are drilled to retain all of the acreage. When complete development appears inadvisable as a result of information acquired during drilling operations, the quitclaim clause becomes important. This clause often holds less and on some occasions more acreage per well than would be retained under the terms of the spacing agreement if the property were fully developed.

Provisions for the payment of ad valorem and severance taxes on the mineral value of the land are usually prorated to the lessee and lessor interests in accordance with their respective participation in the production from the property. The lessor is required to pay the tax on the surface value of the land. The lessee pays the property tax on his producing and other equipment. There are, however, many agreements that permit the lessor to force quitclaim and abandonment of the property when the royalty income does not return, during a specified period of time, a fixed percentage of the current market value of the surface of the land after the payment of all taxes chargeable to the lessor interest. What is the effect of such a lease term on the earning power of a mineral interest, or an overriding royalty interest, on the operating or other working interests? In areas such as the Los Angeles Basin the action of this clause on an estimate of future cash profit may be far reaching.

Many leases grant the lessor the right to take his share of production in kind and then nullify this right. For example, lease form Oil Age 86-C revised, provides: "At Lessor's option, exercised not oftener than once in any one calendar year upon x days' previous written notice, Lessee shall deliver into

Lessor's tanks on the leased premises, or at the mouth of well or pipeline designated by Lessor free of cost. Lessor's royalty oil, provided *that Lessee may at any time purchase and take Lessor's royalty oil at said posted available market price.*"

The right of either party to freely assign their interests, the stop production clause, the right of the lessor to acquire the bore hole for a fixed per cent of the salvage of the casing in the well or wells prior to abandonment, are all parts of a lease document that can and often do influence the earning power of an interest in oil producing land.

Operating Agreements

Operating agreements often impose restrictions on the working interest that do not exist in the original lease. Methods of accounting to participating but non-operating interests, the methods of fixing charges for overhead and supervision, and procedures for the contingent payment of obligations out of oil production are pertinent in the appraisal of oil interests. The collateral value of an interest, that shares in the operating profit but has no voice in the management of the property, is less than that of an equivalent interest that controls operations.

Sales contracts, their existence and general terms, and particularly the cancellation clause, have direct bearing on the operating profit to be derived from oil producing properties. For collateral purposes in time of price instability, a long term purchase contract may be considered advantageous. In period of short supply, the existence of a long term sales contract may be a liability.

The existence of contractual obligations in operating agreements, assignments and contingent oil payments, is not evident from examination of the lease document alone. Specific inquiries should be made as to their existence, their contents and terms.

Data Needed for Appraisal

The acquisition of data, its accuracy and reliability is a major problem with the appraiser of oil properties. In many instances, records of oil shipped and its price are the only factual data available for the preparation of an engineering estimate. Paul Paine's book, *Oil Property Valuation*, contains a check list covering the material desired for a thorough analysis of oil properties leading to an estimate of future recoverable oil and cash profit.

The appraisal of interests in oil production should always include:

The base date (day, month and year) on which the estimate is prepared.

A description of the property, legal preferred.

A brief of the lease document showing such information as the date of the lease, the term, drilling requirements, spacing, development rate, offset distance, quitclaim and method of determining retained acreage, distribution of taxes, the right to take in kind, the abandonment clause, etc.

Run tickets and revenue returns and the receipts of payment to the interest being appraised should be examined. This often shows discrepancies in the net interest or its nature. It is not uncommon to find that what has been described as a royalty is in actuality a participating interest paying some share of the operating costs.

The existence of sales contracts, their general terms and cancellation clause, operating agreements and oil payments should be part of the record.

Data for the preparation of an analytical engineering valuation of oil properties include material for the estimation of:

The amounts of future recoverable oil,

The income to be realized from the sale of oil and its associated hydrocarbons,

The expense connected with its extraction from the ground, its treatment and sale, and the profits to be expected from this operation.

Estimating Oil Reserves

The expression, future recoverable oil or oil reserves, does not have an interpretation that is universally accepted. It should be defined for the management or the client. Used in connection with an engineering appraisal, the term, oil reserves, might well be required to meet the following conditions:

The presence of oil must be proved to a high degree of probability.

The oil must be producible by techniques known today.

The operation must return a profit after the payment of all costs connected with its development, extraction, treatment and sale.

There are many methods of estimating oil reserves. All have one common characteristic. Their use requires judgment and experience. No one method is always acceptable nor can any one method be used in a rigid and routine manner.

The relationships between oil production decline and time, rate of oil production and gas oil ratios, rate and cumulative oil, reservoir pressure and cumulative oil, are all used for the estimation of future recoverable oil. The oil rate-time relationship is one of the oldest and most reliable tools for the estimation of oil reserves. Even this procedure must be used with care. Its accuracy depends upon the length of production histories of the well or wells being appraised, the accuracy of production records, the production of the well or wells at capacity rates.

Capacity production is seldom realized. Curtailment may be imposed on production rates by state law, production costs, prices, and taxes. The last item is playing an increasingly important part in the determination of operating policy.

The decline curve method of estimating future recoverable oil does provide an estimate of the rate at which the oil will be recovered. No other production decline relationship offers this advantage.

The oil rate-cumulative procedure for estimation of future recoverable oil requires capacity production and a gas depletion type reservoir if it is to yield reliable results. The method does not give an estimate of production rate.

The reservoir pressure decline and cumulative oil method of estimating reserves assumes a gas depletion type reservoir with no change in productive index. This system does not produce an estimate of production rates.

The calculation of reserves by the use of material balance equations and the estimation of recovery factors by Tarner predictions or some other formula are in every day use. This approach has much in its favor particularly where unitized operations are underway or being considered. Its application and usefulness still require judgment and experience. The determination of what data is truly representative and the selection of critical factors that will give tenable results cannot be made with uncompromising inflexibility.

The volumetric method of estimating future recoverable oil is easily understood and applied. It therefore enjoys much popularity. It does however lend itself to considerable misuse in engineering estimates connected with the appraisal of oil lands. The adequacy of the material available for a volumetric estimate of reserves should always be tested. Some estimates are prepared without any core analysis of the reservoir material. It is not uncommon to find estimates involving large

amounts of future recoverable oil that have as their foundation the porosity, permeability and/or interstitial water factors developed from the analysis of only four or five samples of the reservoir rock. The choice of a recovery factor alone permits a wide range of results to be derived from identical basic information. The appraisal engineer should carefully describe the quality and source of the data that are the foundation for his estimate.

All methods of estimating reserves, except the projection of oil rate decline *vs* time, require some more or less arbitrary presentation of future production rates. The client or management is interested in the payout period, annual earnings, etc. The best money is the early money. It can be predicated with greater accuracy than can the long delayed earnings. The appraiser may be able to do no more than divide the estimated future oil recovery into equal amounts for the anticipated economic life of the property. Or he may prepare a pattern of future rates of recovery according to his concept of probable operating policies and methods. In every case, the engineer should set forth with clarity what has been done in forecasting production rate and the reasons for the procedure adopted.

Estimating Income

Estimates of future income for an analytical engineering appraisal should be forecast at current commodity prices with consideration given to any existing contractual agreement concerning those prices. For property where future production will see only nominal changes in gas-oil ratios, the forecast of oil, gas and gasoline income in terms of a barrel of oil is acceptable procedure. Properties that may experience a drastic change in gas-oil ratio require careful consideration by the appraiser of the probable future yields of these hydrocarbons. It is not uncommon to find these products producing 20 to 40 per cent of the total income from oil producing properties. The trend toward higher prices for dry gas and the general outlook for an increase in the demand for natural gasoline and liquid petroleum gases will make the income from these substances increasingly important.

The device of using actual realization, *i.e.*

$$\frac{\text{actual income from oil, gas, gasoline}}{\text{actual bbl oil shipped}} = \text{realization per bbl oil}$$

for the estimation of future income is helpful where gas and gasoline yields are expected to remain at approximately current levels. The procedure, in effect, weighs the gravity of the oil, the gas and gasoline production for the individual wells and their respective contributions to the income from the property. Even the use of this device requires care. One well or group of wells may not contribute to present production in the same proportion that it will contribute to future recoverable oil.

The appraisal engineer is not expected to be an economist, nor can he be expected to predict fluctuations in commodity prices. It is proper, however, to advise clients or management of any condition or situation that might affect the price structure of oil and its associated hydrocarbons. Significant developments may range from new manufacturing processes and production techniques to the supply and demand outlook provided by reliable sources of published material.

It is often advisable in analyzing the future earning power of an oil producing property to illustrate the effect of possible changes in the price of oil on the estimate of future earnings.

Expense

The estimation of future expense connected with the extraction and sale of oil, gas and gasoline is a feature of the analytical engineering appraisal. It requires analysis of the future behavior of the reservoir, the drilling operations and production techniques and in some cases even the philosophy of those responsible for producing the oil.

Unfortunately there is no formula or fixed procedure for the estimation of operating cost, supervision and administrative expense. When future profits are estimated for the purpose of loan negotiations, past history is the best indication of probable future performance.

The direct well costs, in other words, all expenses directly attributable to specific wells or leases are fixed within limits by the depth of the producing zone, the capacity and type of production equipment, the number of the wells on the property, the proximity of the lease to other oil production controlled by the same operating interest.

These costs should be forecast in most cases on a well-month or well-year basis. After production reaches the pumping stage, the direct cost of operation experiences but little change since it is related to the depth of the producing zones, the capacity and type of production equipment, etc. Direct well costs may range from $75 per well-month for shallow wells with small fluid production to $1,000 or more per well-month for deep wells producing large amounts of fluid. The lifting cost per barrel of oil produced increases as well productivity declines since direct well expense is relatively constant. Estimates of future operating charges when made on a per barrel basis often fail to increase with sufficient rapidity to offset the decline in well production.

The estimates of direct well costs on a cents per barrel basis find their most useful application when used in conjunction with volumetric estimates of future recoverable oil. A forecast of future production rates and the probable economic life of an oil property does not often accompany a volumetric estimate of reserves. Therefore the unit cost per barrel is most effective here.

One item of operating expense often overlooked is the creation of a sinking or reserve fund for redrill or recompletion work. Most properties in a long lived multiple zone field experience at least one workover program. The usual every day operating costs do not reflect such expense. The engineer preparing an estimate of future cost often does not provide for these somewhat indefinite but nevertheless real costs of a producing property.

Development Costs

Development costs are probably forecast with less deviation from actual experience than any other expense in oil field operations. Minimum development rate is often established by the lease document. Diligent drilling is usually necessary to fulfill lease obligations. The money is spent over a relatively short period of time. Hence the influence on development cost estimates of long time economic trends and changes in drilling techniques is minimized.

In addition to those items of expense that can be assigned to a specific well or property, a realistic estimate of future profit must include the indirect costs connected with the operation of an oil property. With large companies that aggressively replace their reserves, supervisory and administrative overhead are fairly well related to production. These costs can then be estimated as a unit charge per barrel of oil produced.

Where small organizations are appraised, the same items are better related to the number of wells being operated. Administrative and supervisory expense for production owned by an individual or small company is sensitive to change in production rates, prices and management. In these instances, past history does not necessarily reflect future trends. Indirect expense can be controlled. The amount and form of indirect

(Continued on Page 1, Section 2)

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REACHES BOTTOM EASIER, FASTER

A clean line on the pressure chart shows the smoother, easier descent of Hydrospring. And it can be run in as fast as the driller desires.

This important advantage results from a locked open by-pass that squeezes packer through tight holes. It eliminates undue spudding, drill pipe manipulation, and surging pressures on the recording chart. It prevents pressure build up below the packer, and consequent breakdown of formations, possible loss of circulation. It also prevents the forcing of mud into test formation, the fracturing or disturbing of formation, and damaging the hole by tight packer.

All this is but one advantage of Hydrospring Tester. There are many more features:

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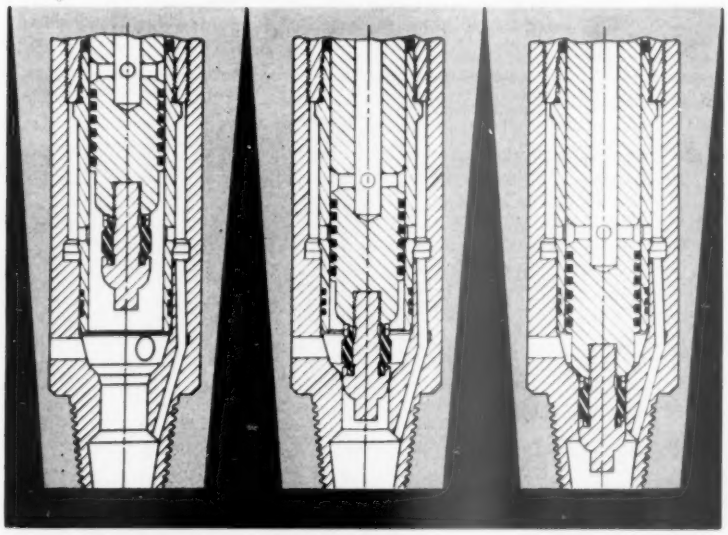
- **It permits reversing off bottom simultaneously with taking closed in pressure.**
- **It can be rotated coming out of the hole.**



Vertical section of tester at start of time delay after weight has been applied.

End of time delay period to allow packer expansion before opening of tester.

Tester is open and full weight of mud is exerted on packer.

Hydrospring has performed perfectly in over 1500 jobs! It's a new concept of drill stem testing that is the talk of the industry and, more than ever, makes Halliburton best for your drill stem test. Get the full story of Hydrospring before you make your next test. Phone your nearby Halliburton Testing Operator or contact Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

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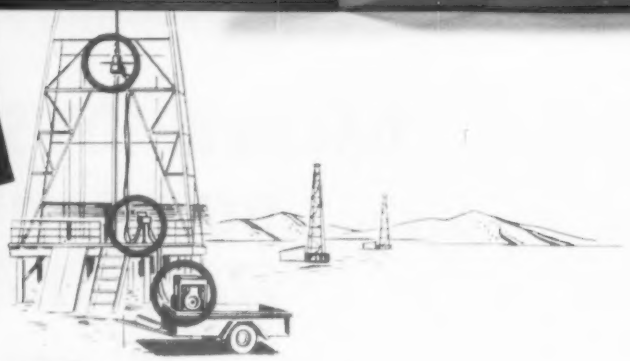
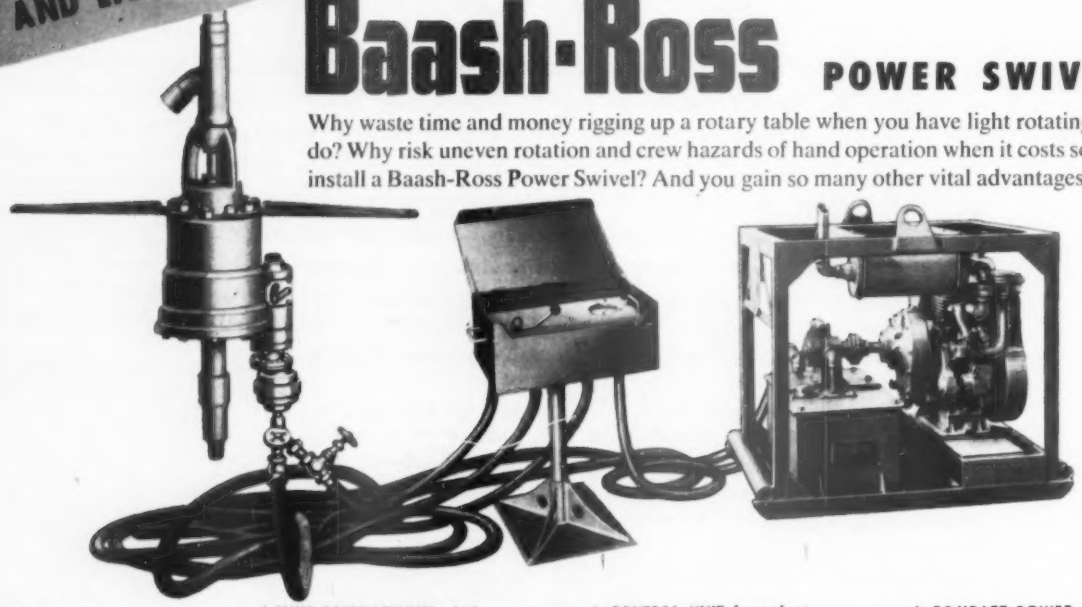


Baash-Ross POWER SWIVEL

Why waste time and money rigging up a rotary table when you have light rotating jobs to do? Why risk uneven rotation and crew hazards of hand operation when it costs so little to install a Baash-Ross Power Swivel? And you gain so many other vital advantages, too . . .



What it is...

The Baash-Ross Power Swivel is a completely portable unit consisting of . . .

1 ***A FLUID-DRIVEN SWIVEL*** **which is hung in the rig and supports the run-in string. This Swivel—driven by oil under pressure in a closed system—rotates either forward or backward, with full control centralized in . . .**

2 ***A CONTROL UNIT*** **located at any convenient spot on the rig floor, which—through a *single* control—permits instant starting, stopping and reversing the rotation of the Swivel unit. Connected to this is . . .**

3 ***A COMPACT POWER PLANT*** **(gas or diesel), located outside the rig and joined to the Swivel and Control Units through hose for supplying the fluid under pressure by which the Swivel is rotated.**

No kelly, no rotary table or other heavy equipment is needed in the rig—nor is any outside power supply necessary. Furthermore, the entire Power Swivel can be easily mounted on a small trailer for quick transportation to any desired field location. It's in service—or on the way to the next job—in a matter of minutes!

TECHNICAL HIGHLIGHTS

Gas Engine (Model HG) . . . 9.2 HP at 2400 RPM (Single cylinder, completely spark-proofed, 2:1 reduction)

Diesel Engine (Model B) . . . 10 HP at 1500 RPM (Two cylinder, direct connected)

Swivel Capacity, Tensile . . . 60,000 lbs.

Elevator Neck . . . 2⅞" O.D.

Lower Connection . . . 2⅜" API I.F.RH. Pin (or as ordered)

Gooseneck Connection (for Mud Hose) . . . 2" API Line Pipe (Female)

Speed Selection (by moving a lever) . . . 10.75 or 21 RPM.

Torque at 10.75 RPM . . . 14,650 inch. lbs.

Torque at 21 RPM . . . 8,380 inch. lbs.

Operating Fluid . . . Ordinary light engine oil, recirculated without loss.

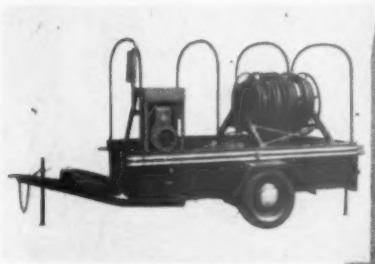
Control Unit may be located up to 30 ft. from Power Unit. Swivel may be located up to 40 ft. from Control Unit—to 70 ft. from Power Unit.

HOW *it saves time, boosts efficiency* . . .

Operators have found the Power Swivel ideal for . . .

- Drilling out sand bridges
- Drilling out cement after squeeze jobs
- Drilling out plugs or other obstructions in casing and tubing
- Rotating cutting tools in fishing operations
- Scraping and cleaning out liners
- Milling in casing and tubing
- Backing off sucker rods and tubing

. . . and many other similar applications.



Power Swivel Mounted on Trailer

Besides eliminating the cost and inconvenience of installing heavy equipment, the smooth sensitive drive of the Baash-Ross Power Swivel has many important advantages. It eliminates the irregularities and uneven feed of manual rotation . . . is far safer because there is no need for the crew to be near the well-head during operation . . . and it has the added advantage that it can be operated at any height in the rig, eliminating need for cutting off the run-in string at floor level!

For any light rotating job you may have—production, drilling, or fishing—be sure to get the full details on this time and money-saver from your nearest representative. Or write direct!

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Valuation of Producing Properties for Loan Purposes

By
Lyon F. Terry
and
Kenneth E. Hill
The Chase National Bank, New York

INTRODUCTION

There are several methods of valuing producing properties and numerous concepts of value, and they all have their purpose. From the standpoint of the lender on oil properties, the primary objective is to judge what might be realized from the sale of the property if it should become necessary to foreclose. For this purpose, the most significant concept of value is the "fair market value" — the price at which the property would be sold by a willing seller to a willing buyer, neither being under any compulsion to buy or to sell, and both being competent and having reasonable knowledge of the facts.[1-4]

The method of valuation generally used by the institution with which the authors are associated is the estimation of the present worth of future profits at that discount rate which it is believed will result in the fair market value. This is often termed the engineering or analytic appraisal method and for several reasons is found most useful in valuing properties submitted as collateral for loan purposes. Most important is to ascertain by our own appraisal that the amount of the loan outstanding at any time could be recovered, if necessary, by foreclosure and sale. Another important factor in judging the goodness of a loan is the ability of the property to generate sufficient net cash income, after all necessary operating, development, and income tax requirements, to amortize the loan within a reasonable time. This is ascertained from a payout schedule which is readily derived by a cut-and-try process from the forecast of net profits used in calculating the value, as shown in Tables IV and V. In addition, when the purchase of a property is partially financed by a loan, the lender and the buyer are in effect acquiring the property jointly. Prudent lenders will avoid participating in a project where the expenses may become so high that the operator might be unable to meet his obligations. And good bankers should avoid being a party to a transaction at a price so high that the customer later finds he has made an unprofitable purchase.

Table 1 — Comparison of Valuation of a Property Under Various Methods of Financing

Refer to Table		Appraised Value	Discount Rate or Rate of Return	Value Per Barrel	Loan Ratio
		Thous. Dolls.	%	$/Net Bbl.	%
2	Purchase for Cash	3,900	8	0.91	..
4	Purchase with Loan	2,500	4½	....	64
	Cash	1,400	11½	....	..
	Total	3,900	8	0.91	..
5	Purchase by Oil Payment	3,500	5½	....	74
	Cash	1,200	12¾	....	..
	Total	4,700	8	1.09	..
	Determination of Value by Oil Payment Method				
	Value by Tables 2 or 4 above	3,900	8		
	Present worth of Tax Savings	800	8		
	Value by Oil Payment Method	4,700	—8		

In the following sections of this paper, the method of valuation generally used by us is described and illustrated by example in Tables II, IV and V, which show the valuation and payout of a loan on the same property under different methods of purchase. The hypothetical property chosen for the examples is based on a typical dissolved gas-drive reservoir in Texas, as described by Muskat.[5] While this paper discusses valuation and loans for the purchase of a producing property, the methods used are equally applicable to all types of loans on oil and gas properties, whether waterflood, gasoline plant, or well-by-well development loans.

PROPERTY PURCHASED FOR CASH

In valuing a property purchased for cash, as shown in Table II, the future production, the gross revenue, and the costs of doing business are estimated year by year and the resulting annual net cash revenues are discounted, in this case at 8 per cent, compounded annually, to arrive at the total present worth of future net receipts, here considered to approximate the value of the property. The value arrived at, $3,900,000, is equivalent to 91 cents per net bbl of oil in the ground. There is nothing sacred about the 8 per cent factor used in this case as the rate of discount, but it appears to the authors to result in a reasonable estimate of the fair market value for this type of property, as indicated by sales of similar properties. It may be interesting to note that E. DeGolyer reports that he is "familiar with cases in which the seller and the buyer have arrived at a trading figure which was approximately one-half of the future net revenue discounted at 4 per cent. It is rather surprising more often than not the latter method, *i.e.*, one-half of a 4 per cent discount future net revenue is very close to the future net revenue discounted at 10½ per cent."[6]

If the rate of discount is too low, the resulting answer will be too high and vice versa. For properties that are fully developed, long-lived, and whose reservoir conditions are well known, estimates of reserves and operating conditions can be made with considerable certainty so that the discount factor should be correspondingly low. And conversely where the opposite is true, the factor should be relatively high.

The discount factor used should be that rate of return or yield on the purchase price which is sufficient to induce a producer to risk his funds in the particular project evaluated

Table 2 — Valuation and Payout of Property "P" Purchased for Cash

	Actual	Estimated Future							
	1952	1953	1954	1955	1956	1957	Total 5 Years	Thereafter	Grand Total	$ per Net Bbl.
NUMBER OF PRODUCING WELLS	30	33	36	37	37	37	—	31		
NET PRODUCTION:										
Crude Oil Thousand Barrels	384	434	460	461	431	396	2,182	2,118	4,300	
Natural Gas Million Cu. Ft.	307	347	414	461	631	780	2,633	10,634	13,267	
	Thousand Dollars									
GROSS REVENUE:										
Oil @ $2.66 per Barrel*	1,021	1,154	1,224	1,226	1,146	1,053	5,803	5,634	11,437	
Natural Gas @ 7.5c per Mcf	23	26	31	35	47	59	198	798	996	
TOTAL	1,044	1,180	1,255	1,261	1,193	1,112	6,001	6,432	12,433	2 89
DEDUCTIONS:										
Operating Expenses	75	82	89	93	95	100	459	1,176	1,635	0 38
Prod. and Ad Valorem Taxes	62	70	76	76	70	67	359	382	741	0 17
General and Administration Expenses	22	24	26	28	30	30	138	300	438	0 10
Intangible Dev. Expenditures	300	150	150	50	60	—	410	125	535	0 13
Depletion and Depreciation†	297	395	419	419	392	360	1,985	1,927	3,912	0 91
TOTAL	756	721	760	666	647	557	3,351	3,910	7,261	1 69
TAXABLE INCOME	288	459	495	595	546	555	2,650	2,522	5,172	1 20
Federal Income Tax @ 52%	150	239	257	309	284	289	1,378	1,311	2,689	0 63
NET INCOME	138	220	238	286	262	266	1,272	1,211	2,483	0 57
Add back: Depletion and Depreciation	297	395	419	419	392	360	1,985	1,927	3,912	0 91
SUB-TOTAL	435	615	657	705	654	626	3,257	3,138	6,395	1 48
Less: Tangible Dev. Expenditures	180	90	90	30	—	—	210	150	360	0 08
NET CASH INCOME	255	525	567	675	654	626	3,047	2,988	6,035	1 40
Discount Factor at 8%	—	93	.86	.79	.74	.68	.79	.49	.65	.65
PRESENT WORTH	—	488	488	533	484	426	2,419	1,483	3,902	0 91

Notes:
* $2.55 for 35° oil plus $0.11 for Natural Gas Liquids.
† 1952 Statutory, thereafter at Cost ($0.91 per Barrel).

rather than in safer investments offering lower yield. The rate must be commensurate with the physical hazards of producing and the economic uncertainties of future production, prices, expenses, and production control. In principle, it is the same incentive as that recognized in the regulation of public utilities where the reasonable rate of return upon the fair value of the property (the rate base) is held to be that sufficient to induce the investment of capital in establishing, maintaining, and expanding the property. The Federal Power Commission, for example, has been allowing a 6 per cent rate of return on natural gas pipe line companies. Assuming adequate demand for the transmission service rendered which these pipe line systems generally enjoy, the companies are practically assured of earnings equal to the rate of return allowed. These enterprises are highly rated by investors and by comparison the employment of funds in producing oil and gas properties should generally deserve a rate of return higher than that obtainable in such public utilities investments.

Table 3 — Return of Investment with 8% Profit

Year	Net Cash Income	Allocation of Net Cash Income to: Earnings at 8%	Allocation of Net Cash Income to: Return of Capital	Investment Remaining at Beginning of Year
	Thousand Dollars			
1953	525	312	213	3,902
1954	567	295	272	3,689
1955	675	273	402	3,417
1956	654	241	413	3,015
1957	626	208	418	2,602
1st 5 years	3,047	1,329	1,718	....
1958	570	175	395	2,184
1959	450	143	307	1,789
1960	385	119	266	1,482
1961	368	97	271	1,216
1962	294	76	218	945
1963	239	58	181	727
1964	181	44	137	546
1965	133	33	100	409
1966	98	24	74	309
1967	104*	18	86	235
1968	79	11	68	149
1969	57	5	52	81
1970	30	1	29	29
TOTAL	6,035	2,133	3,902	....

*No expenditure for pumping equipment required after 1966.

The value sought should be the fair market value of the property as previously described, and if the proper rate of discount is chosen, the answer should approximate this value. Whatever process of valuation is used, the objective is to find what the property would sell for, that is, its fair market value. If the property be purchased at the value found by the engineering appraisal method, the purchase price will be recouped out of net cash proceeds together with a profit on the diminishing balance of the investment, at the same rate of return as the discount rate used in the valuation. This is proved in Table III.

It should be pointed out that provision for estimated income taxes is made in the calculation before discounting estimated future cash income to present worth. The taxes here assumed are computed at the present 52 per cent rate for corporations after allowance for intangible development expense and depletion on cost, which in this case is higher than statutory depletion. Income taxes comprise one of the costs of doing business and must be provided for out of the producing operation. Note that in Table 2 the total future net cash revenues amount to $6,035,000 *after* provision for income taxes. Discounting same at 8 per cent results in the valuation of $3,900,000. Now, if the property be purchased at this price, the purchase price will be paid back, together with 8 per cent per year, on the diminishing balance. The total future income taxes are shown in the table to aggregate

$2,690,000, so that the net cash revenues *before* provision for taxes amount to $8,725,000, the present worth of which at 8 per cent is $5,648,000. Should the property be purchased for this amount, the net future cash proceeds would still be $6,035,000, but the excess of net cash proceeds over the purchase price would be only $387,000, or equivalent to a return of approximately 1¼ per cent per annum. Would you buy the property for a yield of 1¼ per cent?

Carrying this reasoning further to show the danger of omitting provision for income taxes, let us assume that the property is purchased by an individual, subject to a 65 per cent tax rate. In this case the present worth of future net cash receipts *before* income taxes would be as before, $5,648,000. But the income taxes at the 65 per cent rate assumed would be 25 per cent (or $672,000) higher than at the 52 per cent rate shown in Table II, which would reduce the future net cash receipts after taxes from $6,035,000 to $5,363,000 — and the purchaser of the property would never get his money back.

We have observed that the producing properties which often get into difficulties are those whose owners had failed to provide for future income taxes. An oil producer may be so fortunate in successful drilling at an increasing rate that his intangible drilling deductions will preclude income taxes for a number of years. But if such an operator eventually runs out of drilling locations or funds for further development, he may be forced to sell property to meet his taxes or loan obligations.

Purchase Financed by Direct Loan

In Table IV is shown an estimate of the future cash flow from the same property, assuming it to be purchased at the same price, $3,900,000, comprised of $1,400,000 in cash and $2,500,000 obtained by loan. The earnings of the property will be the same as in Table II where it was assumed to be purchased for cash. The income taxes of the operator of the property will be slightly less than in Table II, but the lender will be taxed on the interest received from the operator, so that the sum of the income taxes arising from the operation of the property will be approximately the same. From a practical standpoint, the ownership of the property so financed may be considered as a combined undertaking by the purchaser and the lender since both obtain the return of their capital and profits thereon solely out of the operation of the property. The net cash return from the property is the same as if it were purchased for cash, as in Table II. The 8 per cent return on the property is shown in Table IV to be equivalent to 4½ per cent to the lender and 11½ per cent on the equity funds of the operator.

Comparison of Tables II and IV will show the fallacy of attempting to value property by using a rate of discount equal to the rate of interets that can be obtained on mortgage money. The lender incurs but little risk since his investment is to be repaid first and he may be willing, therefore, to loan at 4 or 5 per cent. But the purchaser, who puts up the balance of the cost of a property, takes practically all the risk and, as shown in Table IV, should be entitled to the 10 or 12 per cent rate of return on his part of the undertaking.

Purchase by Use of Oil Payment

An oil payment is a property right to a specified portion of the reserves and production of a property until the proceeds thereof, free and clear of expenses, shall amount to a

Table 4 — Valuation and Payout of Property "P" Financed by Direct Loan

	ESTIMATED FUTURE								
	1953	1954	1955	1956	1957	Total 5 Years	Thereafter	Grand Total	$ per Net Bbl.
NET PRODUCTION:									
Crude Oil Thousand Barrels	434	460	461	431	396	2,182	2,118	4,300	
Natural Gas Million Cu. Ft.	347	414	461	631	780	2,633	10,634	13,267	
	Thousand Dollars								
GROSS REVENUE*	1,180	1,255	1,261	1,193	1,112	6,001	6,432	12,433	2.89
DEDUCTIONS:									
Operating Expenses	82	89	93	95	100	459	1,176	1,635	0.38
Prod. and Ad Valorem Taxes	70	76	76	70	67	359	382	741	0.17
General and Administrative Expenses	24	26	28	30	30	138	300	438	0.10
Intangible Dev. Expenditures	150	150	50	60	—	410	125	535	0.13
Depletion and Depreciation†	395	419	419	392	360	1,985	1,927	3,912	0.91
Interest @ 4½% per annum	104	84	63	39	14	304	—	304	0.07
TOTAL	825	844	729	686	571	3,655	3,910	7,565	1.76
TAXABLE INCOME	355	411	532	507	541	2,346	2,522	4,868	1.13
Federal Income Tax @ 52%	185	214	277	264	281	1,221	1,311	2,532	0.59
NET INCOME	170	197	255	243	260	1,125	1,211	2,336	0.54
Add back: Depletion and Depreciation	395	419	419	392	360	1,985	1,927	3,912	0.91
SUB-TOTAL	565	616	674	635	620	3,110	3,138	6,248	1.45
Less: Tangible Dev. Expenditures	90	90	30	—	—	210	150	360	0.08
NET CASH INCOME	475	526	644	635	620	2,900	2,988	5,888	1.37
Excess over Loan Requirements	75	76	144	85	20	400	2,988	3,388	0.79
Discount Factor at 11½%	90	80	72	65	58	75	37	41	.41
Present Worth	68	61	104	55	12	300	1,106	1,406	0.33
LOAN AMORTIZATION SCHEDULE:									
Loan at Beginning of Year	2,500	2,100	1,650	1,150	600	—	—	—	—
Less: Principal Payments	400	450	500	550	600	2,500	—	2,500	0.58
Loan Balance at End of Year	2,100	1,650	1,150	600	-0-	—	—	—	—
						TOTAL VALUE		3,906	0.91

Notes:
* Crude Oil Including Natural Gas Liquids @ $2.66 per Barrel.
Natural Gas @ 7.5c per Mcf.
† At Cost ($0.91 per Barrel).

Table 5 — Valuation and Payout of Property "P" Purchased By Use of Oil Payment

	ESTIMATED FUTURE								
	1953	1954	1955	1956	1957	Total 5 Years	Thereafter	Grand Total	$ per Net Bbl.
NET PRODUCTION:									
Crude Oil Thousand Barrels	434	460	461	431	396	2,182	2,118	4,300	
Operator's share Thousand Barrels	130	138	138	129	132	667	2,118	2,785	
Natural Gas Million Cu. Ft.	347	414	461	631	780	2,633	10,634	13,267	
	Thousand Dollars								
GROSS REVENUE*	1,180	1,255	1,261	1,193	1,112	6,001	6,432	12,433	2.89
30% to Operator unt'l O'l Payment liquidated	354	376	378	358	370	1,836	6,432	8,268	2.97
DEDUCTIONS OF OPERATOR:									
Operating Expense	82	89	93	95	100	459	1,176	1,635	0.59
Prod. and Ad Valorem Taxes	36	40	40	36	33	185	382	567	0.20
General and Administrative Expenses	24	26	28	30	30	138	300	438	0.16
Intangible Dev. Expenditures	150	150	50	60	—	410	125	535	0.19
Depletion and Depreciation†	56	59	84	69	104	372	2,015	2,387	0.86
TOTAL	348	364	295	290	267	1,564	3,998	5,562	2.00
TAXABLE INCOME	6	12	83	68	103	272	2,434	2,706	0.97
Federal Income Tax @ 52%	3	6	43	35	54	141	1,266	1,407	0.51
NET INCOME	3	6	40	33	49	131	1,168	1,299	0.46
Add back: Depletion and Depreciation	56	59	84	69	104	372	2,015	2,387	0.86
SUB-TOTAL	59	65	124	102	153	503	3,183	3,686	1.32
Less: Tangible Dev. Expenditures	90	90	30	—	—	210	150	360	0.13
NET CASH INCOME	−31	−25	94	102	153	293	3,033	3,326	1.19
Discount Factor at 12¾%	89	79	70	62	55	.56	.34	.36	
PRESENT WORTH	−28	−20	66	63	84	165	1,035	1,200	0.28
OIL PAYMENT SCHEDULE:									
70% of Gross Income	826	879	883	835	742			4,165	
Less: 70% of Production Tax	34	36	36	34	34			174	
Interest @ 5½% Per Annum	176	139	99	58	19			491	
NET AVAILABLE FOR OIL PAY. REDUCTION	616	704	748	743	689			3,500	0.81
LOAN AMORTIZATION SCHEDULE:									
Loan Outstanding at Beginning of Year	3,500	2,884	2,180	1,432	689				
Less: Principal Payment	616	704	748	743	689				
Loan Balance at end of Year	2,884	2,180	1,432	689	−0−				
TOTAL VALUE								4,700	1.09

Notes:
* Crude Oil including Natural Gas Liquids @ 2.66 per Barrel; Natural Gas @ 7.5c per Mcf.
† 1953-4 at Cost (43c per Barrel), thereafter Statutory.

stipulated sum, plus interest thereon at a stated rate. The residual interest owner is obligated to operate and develop the property without cost to the oil payment owner. The use of an oil payment in the purchase of a property is illustrated in Table V, where it is assumed that the same property as shown in Tables II and IV is purchased for $1,200,000 cash, subject to an oil payment of $3,500,000, plus interest at 5½ per cent, payable out of 70 per cent of the production. The oil payment is sold simultaneously to a third party, who borrows the entire cost of his investment, at 4½ per cent, and retains the 1 per cent difference as interest on which he pays income taxes. He pays no taxes on the balance of his receipts which are construed to be the return of his capital investment on which he is allowed cost depletion. The operator of the property retains 30 per cent of the production out of which he pays his operating and development costs and income taxes. The oil payment is generally designed so that the operator's net income will be quite small and his resulting taxes insignificant until the oil payment has been paid off, when the operator will come into full possession of all the production. Thus, the combined income taxes of all the parties, including the operator, the owner of the oil payment, and the lender, are much reduced until the oil payment has been liquidated. Hence if the property be purchased by this procedure, it will be worth more than if purchased for cash or financed by a direct loan. In the examples shown, the total taxes to all parties (including taxes on interest) amount to $2,690,000 in Tables II and IV and to $1,660,000 in Table V, showing a tax savings of $1,030,000. The present worth of this savings at 8 per cent is $800,000. Adding this increment to the value of $3,900,000 found in Table II indicates a value of $4,700,000 for the same property if purchased by the oil payment procedure, or 20 per cent more than if the property were purchased for cash or by direct loan. It can be shown by mathematics similar to that used in Table III that the purchase price of $4,700,000 will be returned, plus a yield of 8 per cent on the diminishing balance. And as shown in Table V, the 8 per cent average combined return from the property is equivalent to 4½ per cent to the lender, one per cent to the owner of the oil payment, and 12¾ per cent to the operator. The operator has his income long deferred, takes most of the risk and, as in the case of property bought by direct loan, is entitled to a relatively high rate of return.

Comparison of the Methods of Financing

The foregoing treatment of the valuation and payout of the same property under the same assumption of 8 per cent return, but for different methods of financing, as detailed in Tables II, IV and V, is summarized in Table I.

Ratio of Loan to Value

From the standpoint of the lender, it is important to have an ample factor of safety between the amount to be loaned and the estimated value of the security. No estimate of

(Continued on Page 5, Section 2)

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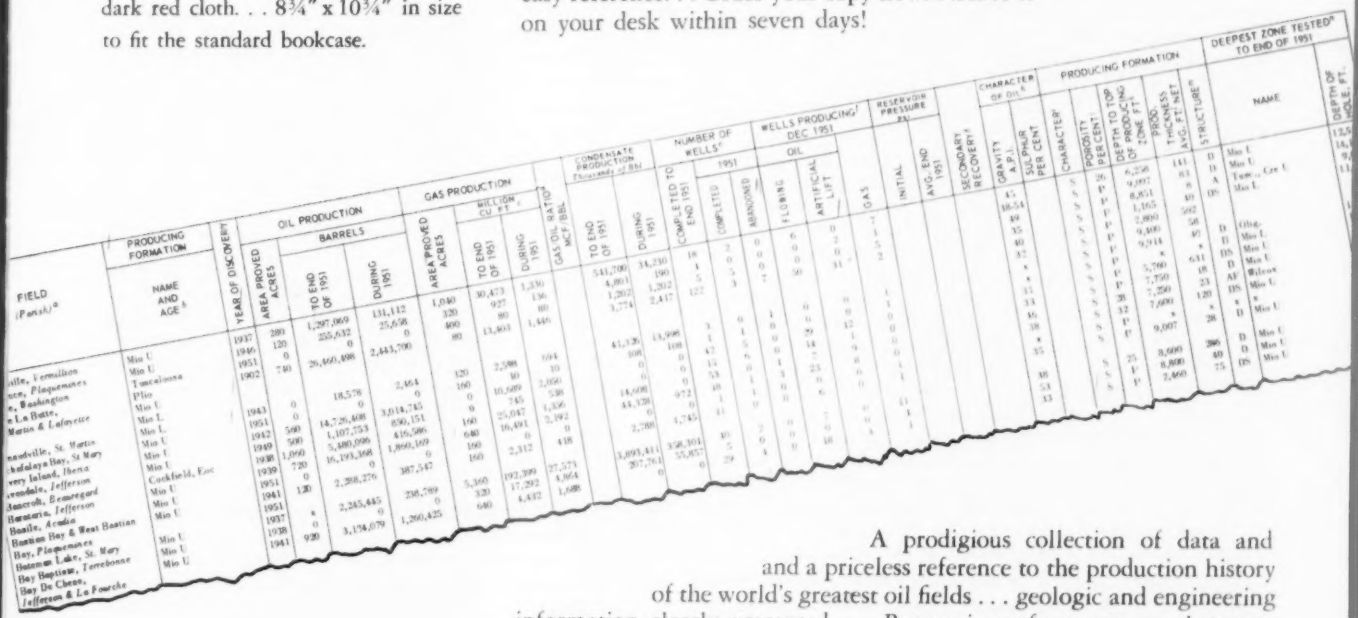

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Valuation Reports and Security Analysis

By

Edwin L. Kennedy
Lehman Brothers, New York

Every professional group in American life seeks to find rules and formulae by which correct decisions can be made easily. Any schoolboy likes to be able to look in the back of the book for the answers to his problems — at least, for the tough ones. There are no answers in the back of the investor's book; no foolproof rules to put money to work in any industry, particularly in the dynamic oil industry, in order to achieve the goals desired by "the typical American investor." We define "the typical American investor" as one who wants to buy something that has the strength of a Government bond; that yields 10 per cent; and that will, at the very least, double in price within six months and one day.

Sometime ago a series of valuation reports were prepared for my firm. They had been prepared for investment guidance a a sufficient number of years previously to permit their conclusions to be tested in the market place. It was disillusioning to find no important relationship between the conclusions of these valuation reports and the subsequent market performance of the common stocks involved. In fact, one of the issues looked upon with the greatest favor because its market price bore an unusually low ratio of about 30 per cent to its then appraised value has had over the years, since the reports were prepared, one of the smallest price gains of any of the major oil issues. It is today selling for about 40 per cent of its appraised value. Of course, the issue's appraised value has increased along with all values in the industry, particularly in the post war period of inflation. This stock entered this period with an abnormally low ratio between market price and appraised value, and this low ratio has continued without making it a good purchase at any time.

This company's stock is not an isolated instance. Other examples over the years taught us not to select issues for investment *primarily* on appraised value. This may seem paradoxical in view of the clear and direct relationship outlined by Lyon F. Terry that exists between lending on a property and its underlying worth as indicated by an appraisal. This generalization does not mean that there is no connection between a stock's underlying asset value and where it sells in the market place. It is clear that such a relationship does exist, but we suggest that appraised value at any given time cannot alone be used as the selecting yardstick, because investment performance after purchase will largely be determined by factors which add new values to those in sight at the time the appraisal is made.

Appraisal Figures and Stock Prices

At present the oils on the New York Stock Exchange are selling at 30 per cent to 150 per cent of appraised values. Such a wide range strongly suggests that there must be many factors other than appraisals entering into market prices. It also raises the basic question whether we should expect a close correlation between appraisal figures and stock prices. An appraisal is an estimate of value based on the assumption of liquidation. An investor normally purchases a security after estimating a company's future based on the assumption that the company is not going to be liquidated. It is fundamentally inconsistent to expect the same tool to measure a company's value on the assumption of liquidation and also measure its worth on the assumption of its continuation as a going concern.

Let us assume the formation of two new corporatoins, each with a million shares subscribed at the same price. Soon after formation one finds 50 million bbl of oil and the other finds 100 million bbl of exactly comparable crude with the same aggregate exploratory expenditure. Under these conditions the market prices for the two stocks ought to have a ratio similar to their underlying value ratios. Actually it would be most unusual to find such an exact reflection of values in market prices. Two newly formed corporations may start off being comparable in every respect, but such a comparison won't continue very long. Every corporation has management, and such management may be poor or good. Managerial policies vary both in their objectives and their effectiveness. In time major and minor differences would develop in these two corporations which inevitably would lead to varying ratios of stock prices to appraised values.

Factors Affecting Stock Price-Appraised Value Ratio

What are these differences that might develop? In the first place, exploration success or the lack of it, particularly in recent years, is a powerful factor in relative market performance of oil equities. Second, financial policies of managements differ and meet with varying responses in the market place. Third, a large proportion of the vehicles available to the investor in the oil industry are securities of concerns that have developed individual patterns of integration into fields other than production. This integration introduces appraisal complications that are hard to resolve. Furthermore, foreign investments and activities further complicate the problem. Finally, there are inherent difficulties in the mechanics of valuation which in some situations make it extremely difficult to calculate into an appraisal figure the factors having the greatest bearing on the creation of new values.

Exploration Success

An appraisal of a property or a company assumes that cash flow directly supports and determines value in liquidation. There is no such direct connection in a going concern. Managements used all, more than, a part of, or none of the cash flow to perpetuate the company in business. Results from

using this cash flow for exploration vary both in the time and the continuity with which they appear as well as in the worth of the results themselves. The stock market usually does not give very pronounced attention to a liquidating situation in the oil industry. Market prices will tend to be depressed in relation to appraised values where a substantial part of cash flow is unsuccessfully used for exploration. Market prices advance toward underlying values or even exceed them where management establishes, through luck or ability, a sustained success in its exploratory effort. In either case appraised value becomes only a base, a point of departure, from which a purchaser of stocks attempts to assess the future.

This assessing of the future is not always accurately or even intelligently done by the market. This leads to over or under-discounting of the exploratory effort with corresponding sharp changes in the stock price-appraised value ratio. There are decided fashions of interest in the securities market, such as the pronounced Williston Basin fever of the past year. Oil management knows how difficult it is to evaluate a discovery immediately after it is made. A decade ago there was little market response to discoveries until considerably after the facts were available to indicate their importance. Development drilling had proceeded far past the point of indicating a major discovery, for instance, before Velma affected the market action of Skelly stock. Recently the market has frequently been willing to discount a slight staining or fluorescence in a wildcat well. This has led to some amazing incongruities for many discoveries don't pay out. Not too long ago a company announced a discovery as the deepest producer in the world. Instead of accepting the warning that depth influences commercial status, the market quickly added $40 million to the aggregate price of the company's stock. The only difficulty was that the well never paid out.

The ramifications of this sensitivity to exploration sometimes are a serious problem to one who attempts a rational approach to investment selection. Who can state whether an initial $80 million market increase by Kern County Land was the proper response to Wheeler Ridge? How do underlying values aid one in selecting vehicles to share in the bright Canadian oil future? How does one rationalize the marked rise in price of Northern Pacific stock where little oil has yet been found but where prospects are thought to be excellent? Questions of this sort can be enumerated almost without limit. Little help toward answering them can be gotten from appraisals, because market prices for securities frequently move ahead of known facts and figures.

Financial Policies of Management

Exploration requires money; consequently exploration policies may contribute to varying financial policies. Sometimes these financial factors become dominant ones in the pricing of securities. Some companies report small earnings per share and keep dividend payments low. This is partly due to accounting policy, but mostly it is due to the intent to use a large proportion of the annual cash throw-off to explore and develop. This holds down tax liability and permits a simple capital structure to be maintained. The trend of prices in this type of equity is strongly influenced by exploration success or failure. Other companies pursue operating policies and use accounting procedures which lead to more stable profits reports. Usually these companies pay dividends regularly. Frequently they borrow a part of capital needs, and sometimes they ask stockholders to put additional funds into the business. In a few cases the stockholders receive stock dividends pretty consistently as tangible evidence of the managements policy to grow from within.

These policy variations may result in enormous differences in tax position. Full exposure to or relative immunity from the very high tax rates of the past decade lead to completely different results to the investors.

It would be unusual if differing exploratory and financial policies of the two corporations mentioned above did not in time lead to dissimilar capital structures. One might elect to grow through purchasing properties and pyramiding its senior securities, after using up cash reserves. The other might maintain a common stock capitalization reinforced by an ever-increasing cash position. In a period of deflation or adverse market psychology the first company will tend to be adversely evaluated; while in a period of inflation, when debt is said to be an asset, its management will be hailed for its acumen. On the other hand in a period of inflation, investors become intrigued with trying to calculate how much the value of the cash of the second corporation has shrunk; they neglect it and its stock becomes depressed as measured either by other equities or its own appraised value. Examples of both could be enumerated currently. The point is that different capitalization and financial policies make it difficult to maintain a closely recognizable connection between appraised values and security prices, for such policies accentuate the changing moods of investors.

Effects of Integration

Thus far our two corporations restrict their activities to domestic crude production and exploration. If this assumption applied to all issues available in the market place, perhaps appraised value might become more of a dominant and controlling factor than we sometimes believe it is. Integration brings many new problems to the appraiser which are difficult to handle or even to understand. Integration adds manufacturing and marketing and transportation to production, and the economic forces determining whether there is an adequate retrun on the added investment are quite different. Return on nonproducing investment not only varies more widely than production from year to year and from company to company, but such investment complicates capital needs. Requirements for capital to offset obsolescence and to meet growing demand must be made even though the return on the investment may be inadequate or less than could be gotten by putting the same amount to work in production. Refining and marketing is a different business in which only a few concerns have over the last 20 years avoided losses in the tough years and made a really good return in the good years. As a result, integrated companies have consistently sold at lower ratios to appraised values than straight producers. Do not construe these comments as indicating an adverse view toward integrated concerns. Generally speaking, the most conservative and stable investments to be found in the industry are the large integrated concerns. In spite of the prejudice in the financial district against nonproducing assets, particularly refining and marketing, there are many examples of extraordinary accomplishment in this field. Ashland Oil not only earned good money in this activity at a time when most of the industry was not doing so, but its history constitutes an amazing record as a growth situation. Standard of Kentucky, a marketing concern solely, enjoys good investor acceptance whereas the marketing investment of most integrated companies does not. In time the better financial results of recent years from nonproducing activities may lead to a correction of this attitude. This correction is partially under way now where integration includes chemical manufacturing, for chemical earnings are generally considered to be quality earnings.

Foreign Operations

To bring our two companies further into line with the field as the investor finds it, let us put them into foreign operations. After the expenditure of lots of money and years of effort —

during which time we don't know how the appraiser handled the situation — one became a successful producer in Venezuela and the other in the Middle East. After this success we still don't know how the appraiser values foreign production with all of its ramifications — political and otherwise.

The simple corporations with which we started have become increasingly more complex through (1) domestic production accompanied with widely varying exploratory success; (2) refining, marketing, transportation and chemical manufacturing, each with varying economic characteristics; and (3) foreign production which I believe can be valued only on a very arbitrary basis. It is my contention that the problems of valuation are compounded with this complexity as we attempt to bring all of these activities into a single appraisal figure for the investor's guidance. Suffice it to say I haven't yet found a way to equate horses, raccoons and sailfish into a single meaningful figure.

The Mechanics of Valuations

The inherent mechanical problems of a valuation report increase with complexity of activity. They are quite apparent where a special quality needs to be measured. Still other problems arise from the time factor. An appraisal must largely reflect economic factors obtaining at the time the appraisal is made, whereas the investor whose eyes are directed toward the future may be motivated by the possibility of a change in these factors — especially higher or lower prices. An appraisal of a company owning natural gas reserves committed to low prices under long-term sales contracts can only reflect the contract status, whereas the investor may be discounting the possibility that the strong upward trend of natural gas values generally will in one way or another change realization. Another example arises in the case of poor-quality crude or poorly located crude. A valuation report of the very low-gravity crudes of California three years ago would have indicated a figure completely different from that indicated by an accurate guess of the supply and demand economics for the entire California industry.

Companies are as unique as the men who make or manage them. A "feel" arising from a critical analysis of the management of a company and its policies is, perhaps, the most important single factor in investing. These unique qualities do not lend themselves easily to a dollar common denominator. Some stocks sell on a yield basis and at price-earnings ratios that usually do not depart far from the price-earnings pattern of the general market. They tend to become general market stocks or general market oil stocks. Most of the "Standard Oil" stocks, Gulf and Texas are examples of this group. Other common stocks, of which Amerada is the textbook example, sell on the past record of continuous addition to capital values and the immediate prospects of further additions and only secondarily on a relationship to a guess of market value of assets. Still other stocks are "special situations"; *i.e.* they are vehicles to pursue individual objectives such as tidelands developments, an expanding market for natural gas, the possibilities of the Williston Basin, the California industry, etc.

Investing has been defined as selection of risks appropriate to the needs of each individual investor. One can invest, speculate or gamble. An appraisal report can play a vital role in this basic risk determination and hence of proper initial guidance so that the investor doesn't find himself to be a wildcatter in the market and the speculator find himself to be an unwilling investor. While it would be difficult to overestimate the importance of an appraisal report in this initial step, it is much easier to overestimate its use in other phases of the selection process. Investors do not try to put money to work by buying some of all issues available. Rather they choose a limited number of issues that suit their purposes. Hence, selection of stocks becomes a competitive procedure. Appraisal reports provide varying and sometimes only limited aid in procedure beyond the initial step of risk evaluation. A company's exploratory potential which we have come to refer to as its "unfinished business" and the difficulties of equating different types of assets into a single figure constitute a part of the explanation of this statement.

Other considerations which limit the use of appraisal reports in the competitive aspects of selection arise from the limited availability of formal valuation information. In many cases information is not available for anything approaching an appraisal; yet somehow the securities of these concerns are priced in the market place. Furthermore, policies on disclosure of information to stockholders vary. It is not unusual for a laggard company in this respect to have a low ratio of market price to underlying value. Others achieve the same result by handling their stockholder and public relations in a way that leads people to believe that management is trying to promote market performance.

Recently we were asked to value the stock of a family enterprise for transfer purposes involving tax and other considerations. We were asked to state a figure at which we would be willing to buy a portion of the common-stock equity for a public underwriting. Perhaps our use of the appraisal approach in handling the problem may be of some interest in this discussion.

Appraisal Procedure

The first step in this common-stock appraisal was to secure a complete valuation report of the company's assets. This was found to be approximately $67,000,000 comprising over 55,000,000 of market value of oil and gas reserves, $5,000,000 of undeveloped leaseholds, $2,000,000 of net working capital, and $5,000,000 of miscellaneous assets. Similar valuations were prepared for six oil companies having a listed market which were thought to be comparable to the company being appraised. It was found that the common stocks of these six concerns were priced in the market at discounts ranging from 43 per cent to 55 per cent of appraised values. A discount factor of 40 per cent was applied to the $67,000,000 appraisal figure in order to arrive at an indicated market value of $40,000,000 on an all-common-stock capitalization basis, assuming a division of such capitalization into a sufficient number of shares for an adequate market. Factors entering into this determination included the excellent standing of the management in the oil industry; the company's comparatively small size (the financial markets were then favoring small concerns with a discovery potential); the record of the concern as an oil finder; and the favorable prospects of its undeveloped acreage, for a considerable part of it was well located in areas where important developments were taking place. In short, there was thought to be enough romance in this picture to attract interest but not so much that it would raise doubts.

A similar comparative study was made of the cash throwoff of this corporation and the six listed companies before reserve charges. A further comparison was made of reported net income where accounting procedure permitted. These earnings studies supported quite closely the discounted asset value figure.

Considerable thought was given to the allocation of the $40,000,000 figure to the company's pyramided capitalization. In addition to an outstanding bank debt the owners of the common stock also held other senior securities of a considerable amount. Because of their terms and conditions, these

(Continued on Page 7, Section 2)

TENTATIVE PROGRAM

for

Papers and Activities

PETROLEUM BRANCH, AIME, FALL MEETING

Adolphus and Baker Hotels, Dallas, Texas, October 19, 20, 21, 1953

(All papers shown are subject to change or withdrawal)

SUNDAY, OCTOBER 18

10:00 a.m. — Petroleum Section Conference
1:00 p.m. — Registration

Monday, October 19

FIELD CASE HISTORIES

278-G: *The Production History and Pool Performance of the Coldwater Field in Michigan*, by R. L. McCormick and co-author, Sohio Petroleum Co.

331-G: *Performance of a Water Drive Field, Torchlight Tensleep Reservoir, Wyoming*, by Stanolind Oil & Gas Co. authors.

280-G: *Pressure Maintenance by Gas Injection in the Brookhaven Field, Mississippi*, by J. B. Justus, R. W. Cassingham, C. R. Blomberg, and W. H. Ashby, Jr., The California Co.

PRODUCTION EQUIPMENT

281-G: *Metallurgical Aspects of Sucker Rods and Their Oil Well Performance*, by Frederick J. Radd, Continental Oil Co.

282-G: *A New Gas Lift System*, by R. P. Vincent and L. B. Wilder, Stanolind Oil & Gas Co.

283-G: *Automatic Lease Operations, Weeks Island Field, Louisiana*, by Tukner P. Northern, Gulf Oil Corp.

284-G: *Pump Volumetric Efficiency — A Study of the Effects of Pumping Variables*, by C. A. Connally, C. R. Sandberg, and N. Stein, Magnolia Petroleum Co.

GENERAL INTEREST SESSION

285-G: *Professional Development — The Next Phase of Petroleum Engineering*, by Joe B. Alford, Executive Secretary, Petroleum Branch, AIME.
(Two additional papers to be selected.)

Tuesday, October 20

DRILLING FLUIDS

288-G: *An Inexpensive Mud for Deep Wells*, by H. F. Coffer, Continental Oil Co.

289-G: *Filter Loss to Permeable Formations During Drilling*, by C. K. Ferguson and J. A. Klotz, California Research Corp.

290-G: *Mechanical Treatment of Weighted Drilling Muds*, by R. S. Hoch and Roy A. Bobo, Phillips Petroleum Co.

291-G: *Drilling Mud Control in the Southwest Louisiana Coastal Area*, by C. R. Claus and G. A. Standish, Magnolia Petroleum Co.

ECONOMICS AND MANAGEMENT

(Four papers to be selected.)

RESERVOIR FLUIDS

297-G: *Viscosity of Hydrocarbon Gases Under Pressure*, by David B. Burrows and Riki Kobayashi, Continental Oil Co.

298-G: *Effect of Pressure and Temperature on Oil-Water Interfacial Tensions for a Series of Hydrocarbons*, by Hohey El-Din Hassan, Ralph F. Nielsen, and John C. Calhoun, Pennsylvania State College.

327-G: *Equilibrium Vaporization Ratios for Reservoir Fliud Containing a High Concentration of Hydrogen Sulfide*, by H. A. Vagtborg, Jr., The Pure Oil Co.

328-G: *Recovery of Light Hydrocarbons by Gas Cycling a Semidepleted Dark Oil Sand*, by C. N. Simm, California Research Corp.

For Discussion Only:

296-G: *A Method for Determination of Average Pressure in a Bounded Reservoir*, by C. S. Matthews, F. Brons, and P. Hazebroek, Shell Oil Co.

PRODUCTION OPERATIONS

299-G: *Measurement of Water Cut in Production Testing*, by R. M. Howard and M. Ratway, Gulf Research & Development Co.

300-G: *Plugging Off Water in Fractured Formations*, by G. C. Howard and P. P. Scott, Jr., Stanolind Oil & Gas Co.

312-G: *A Ten-Pound Cement Slurry for Oil Wells*, by Roscoe C. Clark, Jr., Continental Oil Co.

313-G: *A Simplified Cementing Technique for Recompletion Operations*, by T. A. Huber, G. H. Tausch, and J. R. Dublin, III, Humble Oil & Refining Co.

TUESDAY P.M., OCTOBER 20

GEOLOGICAL ENGINEERING

303-G: *Red Fish Bay Field, Nueces County, Texas*, by O. J. SHIRLEY and D. R. DUNHAM, Shell Oil Co.
(Two additional papers to be selected.)

RESERVOIR MECHANICS

306-G: *Unsteady State Radial Flow of a Non-Ideal Fluid through Porous Material*, by D. S. HOWARD, JR., JIM DOUGLAS, D. W. PEACEMAN, and H. H. RACHFORD, JR., Humble Oil & Refining Co.

307-G: *A Study of Displacement in Microscopic Capillaries*, by CHARLES C. TEMPLETON, Shell Development Co.

308-G: *Displacement Experiments in a Consolidated Porous System*, by J. S. LEVINE, Shell Development Co.

309-G: *Mobility Ratio — Influence on Oil Recovery After Breakthrough*, by A. B. DYES, B. H. CAUDLE, and R. A. ERICKSON, Atlantic Refining Co.

Wednesday, October 21

WELL COMPLETION

310-G: *Interrelation of Resistivity and Potential of Shaly Reservoir Rocks*, by F. M. PERKINS, JR., H. R. BRANNON, JR., and W. O. WINSAUER, Humble Oil & Refining Co.

311-G: *A Contribution to Electrical Log Interpretation in Shaly Sands*, by A. POUPON, M. E. LOY, and M. P. TIXIER, Schlumberger Well Surveying Corp.

301-G: *Electric Logging in Thin Beds*, by LEENDERT DE-WITTE, Continental Oil Co.

302-G: *An Experimental Investigation of the S.P. and Resistivity Phenomena in Dirty Sands*, by M. R. J. WYLLIE and P. F. SOUTHWICK, Gulf Research & Development Co.

SECONDARY RECOVERY

314-G: *The Effect of Surface and Interfacial Tensions on the Recovery of Oil by Water Flooding*, by HARVEY T. KENNEDY and ERASMO T. GUERRERO, A&M College of Texas.

315-G: *Surface Facilities for Water Flooding at Salem Field, Illinois*, by R. L. LIVINGSTON, The Texas Co.

316-G: *Twelve Years of Gas Injection in a Frio Sand*, by B. T. MILLIKIN, JR., Continental Oil Co.

325-G: *Estimated Effect of Vertical Fractures on Secondary Recovery*, by PAUL B. CRAWFORD and R. E. COLLINS, Texas Petroleum Research Committee.

For Discussion Only:

326-G: *The Effect of Surface Active Chemicals on Gravity Drainage*, by CHARLES P. MILNER, The University of Texas.

WELL COMPLETION

317-G: *Reservoir Fracturing — A Method of Oil Recovery from Extremely Low Permeability Formations*, by L. E. WILSEY and W. G. BEARDEN, Stanolind Oil & Gas Co.

318-G: *The Mechanics of Fracture Induction and Extension*, by WILLIAM J. MCGUIRE, EUGENE HARRISON, and W. F. KIESCHNICK, JR., Atlantic Refining Co.

319-G: *Effectiveness of Gun Perforating*, by T. O. ALLEN and J. H. ATTERBURY, JR., Humble Oil & Refining Co.

320-G: *Practical Aspects of Gravel Packing*, by C. J. RODGERS, Gulf Oil Corp.

NATURAL GAS

321-G: *The Combustion Gas Turbine — Historical Development and Present Day Applications to Natural Gas Pipelines*, by TRACY S. PARK, JR., Tennessee Gas Transmission Co.

322-G: *Multi-Phase Co-Current Flow of Fluids in Horizontal and Vertical Pipes*, by R. L. HUNTINGTON, The University of Oklahoma.

323-G: *Design of Two-Phase Gathering Pipelines*, by OVID BAKER, Magnolia Petroleum Co.

324-G: *Characteristics of Low-Temperature Separation Processes*, by W. P. SCHULTZ, J. O. UPCHURCH, and H. E. STAMM, III, Humble Oil & Refining Co.

330-G: *The Isochronal Performance Method of Determining the Flow Characteristics of Gas Wells*, by M. H. CULLENDER, Phillips Petroleum Co.

Ambassador Hotel Will Be Site of Pacific Petroleum Chapter Meet

The Ambassador Hotel in Los Angeles will be the site of the 1953 Pacific Petroleum Chapter Fall Meeting, to be held Thursday and Friday, Oct. 1 and 2. The meeting will be centered around two days of technical programs, but will also include two good entertainment functions.

Papers already selected for the program, under the direction of C. C. Liedholm of Signal Oil & Gas Co., chairman of the program committee, are as follows:

"Contribution to Electric Log Interpretation in Shaly Sands," by A. Poupon, M. E. Loy, and M. P. Tixier, Schlumberger Well Surveying Corp.

"Improved Hydraulic Rodless Pump Performance Through Use of Electrical Sediment Separator," by R. E. Phelan, Shell Oil Co.

"Oil Base Emulsion Drilling Fluids, Their History and a Laboratory Evaluation of Their Characteristics," by Charles C. Wright, Oil Well Research, Inc.

"Spinner Surveys," by Clarence Dale, The Dale Co.

"Performance of Upper Terminal Zone, Fault Block III, Wilmington Field," by George August, Long Beach Oil Development.

Forum on Directional Drilling —

Panel members from: Union Oil Co., Richfield Oil Corp., Long Beach Oil Development, Signal Oil and Gas Co., Southwest Exploration Co.

The meeting this year will be conducted entirely under the sponsorship and management of the Pacific Petroleum Chapter, of which F. Lowry Wadsworth, General Petroleum Corp., is Chairman. In previous years the meeting has been considered as a Petroleum Branch, AIME meeting, but this year it will be named and conducted as the Pacific Petroleum Chapter Fall Meeting. The reason for the change is to enable the Petroleum Branch to conduct only one major Fall Meeting each year. This meeting will be held in Los Angeles in 1956, and the Pacific Petroleum Chapter meeting will be combined with it in that year.

Exhibits will be held as a part of the meeting this year. A luncheon on Thursday, Oct. 1, and an evening function on Friday, Oct. 2 are now in the planning stage, but final arrangements have not been made. ★ ★ ★

Valuation of Oil Properties

(Continued from Page 19, Section 1)

costs is often dictated by tax considerations. The small company, whose principal stockholders are the management and operators of the property, often absorbs profits that might be dividends, in the form of corporate salaries. This avoids the double income tax. Hence the profit and loss statements for such organizations do not necessarily reflect in their cash profits the true earning power of the property. The ability of the individuals involved to adjust themselves to changing economic conditions, to reduce overhead and partake directly in field operations, becomes important to the appraisal engineer in his efforts to estimate the minimum limits to which overhead costs could be pared.

Operating Cash Profit

Cash profit, sometimes called operating cash profit, net revenue, and operating net revenue, has a variety of meanings and requires definition. The term, cash profit, as used here, is equivalent to income less all costs except depletion, depreciation and income tax. There is no correlation between oil prices and cash profit. The ratio of unit profit to price ranges from almost nothing to 80 or 90 per cent. The most significant use of cash profit estimates is the measurement of the relative values of oil producing properties. Seldom does the estimate of future cash profit, except for very limited time periods, come close to actual experience.

Present Worth

The use of discount factors to reduce future earnings to a present worth seems to be significant to many people. The application of discount factors should be limited to the use value of money. In other words, it should give effect only to the loss of interest on money that cannot be used immediately because it will not be received until some future time.

Market Value

In addition to the estimated earning power of an oil producing property, its market value is of interest to the lender of money and the security analyst. Market value is the price at which various types of interests in oil producing properties are changing hands. It reflects the current opinion of those who buy and sell oil interests.

The prices paid for oil properties do not always appear to be justified by the results of an analytical engineering appraisal. In such cases, it may be that the intangible features of the contracts bearing on the values of the oil interest do not lend themselves to engineering analysis. However, the analytical engineering appraisal is a useful yardstick for the measurement of the relative values of oil producing properties.

In addition, there are other means of measuring relative value, for settled production, the ratio of purchase price to daily barrels of oil net to the interest, for flush production, the dollars per barrel of reserve or the dollars per dollar barrel of reserve. The latter method modifies the effect of price differential.

Some buyers are interested in the time required to return the purchase price, either before or after deductions of income tax costs, and some are interested in the ultimate earnings that may be realized.

It should be remembered that the market values of oil properties fluctuate. They do not remain constant for any extended period of time. Changes in oil, gas and gasoline prices can, almost overnight, increase or depress the sales value of an oil interest. In California, earthquakes have reduced the market value of an oil property in a matter of seconds.

The estimate of market value is good only for the date for which it has been prepared.

Value of Unproved Acreage

In the analysis of the value of the stocks of oil producing companies, the holdings of unproved but prospective acreage is important. The acquisition of well chosen unproved acreage is the life blood of any progressive oil company. The production of oil is in reality a reduction in capital assets. Therefore a company that does nothing to replace reserves is actually in the process of liquidation and the value of its stock should be judged accordingly.

Unproved land cannot be credited with reserves. It has no earning power. It must be appraised on the basis of market value. The market value of such acreage is mercurial. It changes rapidly with developments in the immediate vicinity of the individual parcels of land. The results of a core, a formation test, or completion, may well change the market value of unproved land many times, in a short period of time. A company holding acreage on the trends of known oil producing geologic features and with a good geographic distribution of such acreage will not only replace but will probably increase its reserves, hence its assets. The existence of such unproved acreage in the portfolio of an oil producing company regardless of the actual dollar value is encouraging for it represents an aggressive and forward looking policy. ★ ★

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Bylaws Change Affects Technical Paper Release

Heretofore the AIME Bylaws have not been specific as to the ownership of papers presented at Institute meetings. The only such reference in the Bylaws is in Section 3 of Article XI, which states that "Papers presented at Local Sections, and discussions thereon, if reported, shall be the property of the Institute. Such papers shall not be published elsewhere in extenso without permission of the Board." Questions have often arisen as to publication rights of other papers.

Three years ago a committee consisting of H. A. Meyerhoff, chairman, with R. M. Foose and C. C. Long, was named to study the matter of the ownership and release of technical papers presented at AIME meetings. Reports of the committee, and staff discussions thereon, have been recorded in the minutes of various meetings of the Board. Proposed amendments to the AIME Bylaws, which will be voted on at the Sept. 22 meeting of the Board, seem to meet wtih general approval, and the Board, at its meeting on June 17, directed that they be published.

It is proposed to amend Article 10 (page xlvi in the current Directory) by adding Section 2, which would read as follows:

All papers presented before meetings of the Institute — Annual, Regional, Branch, Divisional, and Local Section — are the property of the Institute, except those previously published elsewhere, those withheld from publication by the author, or those released by the Secretary of the Institute.

It is also proposed that the sentence above quoted in Article XI, Section 3, be amended as follows:

Papers presented at Local Section meetings, and discussions thereon if reported, shall be the property of the Institute, except those previously published elsewhere, those withheld from publication by the author, or those released by the Secretary of the Institute. (The sentence immediately following, beginning "Such papers," is to be deleted.) ★ ★ ★

Engineer Societies Consider Purchase of New Building

For several years there has been discussion about securing a new building to house the societies now occupying the Engineering Societies Building in New York. Space in this building is inadequate and its facilities outmoded, being 47 years old. No definite conclusion has yet been reached about a new building but present activity indicates that a definite proposal will be offered the Founder Societies before the end of the year. Within three to five years a new building may be ready for occupancy.

Preliminary plans are for a new building with 180,000 sq ft of usable floor space, compared with 118,000 in the present building. Additional societies can then be accommodated. About $2,000,000 is available from anticipated sale of the present building and accumulated reserves of United Engineering Trustees that could be utilized for the purpose. A new site might cost $1,500,000, possibly much less. Something on the order of $6,000,000 for the entire new building project is envisaged.

Though the preference is for a building in mid-town New York, headquarters in other cities will also be considered. An active project for an engineering center in Pittsburgh is under way and a definite proposal is expected shortly. It is hoped that the land required for the new building may take the form of a gift, and that possibly a substantial part of the money required for the entire project may be raised by contributions. ★ ★ ★

Method of Naming Officers Due Study by AIME Group

Following suggestions made by the Chicago Section, AIME, and the Minerals Beneficiation and Coal Divisions, that a committee be appointed to review the present method of nominating AIME officers, the Board, at its June 17 meeting, named the following to serve on such a committee: J. B. Morrow, chairman; Clayton G. Ball, L. E. Elkins, W. M. Peirce, W. B. Stephenson, and Andrew Fletcher, ex officio. The present procedure is detailed in Article IX of the Bylaws (page xlv of the current Directory) and in "Information and Advice to Members of the AIME Nominating Committee," page xxxi. The committee will appreciate hearing from individual members or groups who have constructive suggestions to offer for improvement, or who wish to commend the present rules. These were extensively revised just three years ago by the Board, following recommendations of another committee appointed for the purpose. ★

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Personals

MARION L. AYERS has joined the Gulf Oil Corp. in Penwell, Tex. He was previously with the U.S. Bureau of Mines in Wichita Falls.

+

N. DEAN ALTIMUS has been transferred from Lubbock, Tex., to the Cody, Wyo., district office of Stanolind Oil and Gas Co.

GAIL A. BARRY, formerly petroleum geologist with William H. Spice, Jr., consultant, has joined Paul J. Moore in a partnership. The new firm will be known as Barry and Moore, Petroleum Consultants, and will maintain offices in the Alamo National Building in San Antonio, Tex. Barry received his BS degree in geology from the University of Texas in 1940. He was with Petty Geophysical Engineering Co. for a year and a half before entering the armed services. Since his release in 1944, he has been with the Spice firm. Moore, a 1940 petroleum engineering graduate of Texas A&M College, has been a petroleum consultant for five years. Prior to this, he served five years with the Gulf Oil Corp. and three years with Humble Oil and Refining Co. Barry and Moore will operate primarily in the South Central and Gulf Coast Area of Texas.

McCann

Collett

WAYNE L. MCCANN, recently associated with Stanolind Oil and Gas Co. as district engineer in the Shreveport office, is opening an office as consulting petroleum engineer and geologist, specializing in property appraisal, development, and operation.

+

AARON CAWLEY, just released from the navy, will resume his employment with the Honolulu Oil Corp. as a field production engineer in Denver City, Tex.

+

J. DAVISS COLLETT, president of the newly-chartered Association Equipment, Inc. of Houston, has announced the formal opening of the company, which will develop and produce oil field specialty productions.

+

T. H. ACRES, of Sunray Oil Corp. in Los Angeles, was recently honored with a "Citation of Service" presented to him at the Pacific Coast District Meeting of the American Petroleum Institute. The citation was for outstanding service to the district as district chairman of the Pacific Coast District this year and for serving as general chairman last year.

+

MILAN G. ARTHUR, Union Oil Co. of California, will succeed Acres as Chairman of the Pacific Coast District, American Petroleum Institute, Division of Production.

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Valuation for Loan Purposes

(Continued from Page 26, Section 1)

reserves nor forecast of future earnings can be perfect. There is always the uncertainty of estimating future production, the possibility of fluctuation in the price of oil, and the hazard that the actual costs of operations and future development may overrun the best of estimates.

In financing this property by a direct loan, the ratio of the loan to the estimated value of the property (the loan ratio) in the example shown is 64 per cent. In our experience, a loan ratio of 60 to 70 per cent is ordinarily good practice and a reasonable percentage of the value of the property, depending upon other factors that should be considered. Another test of the safety of a loan is that the estimate of total future production from the property should be at least twice as great as the production required to pay off the loan. In fact, if this last qualification is met, the loan ratio will be within the above range because the present worth of net cash income from the first half of the future production generally approximates this percentage of the total value.

In oil payment financing, the loan ratio is usually higher than for direct loans. The higher the ratio of the oil payment to the value of the property, the greater will be the savings in taxes, all of which savings being available for the repayment of the loan. The savings in taxes increase the total net return from the property, and hence the value of the property. It should be pointed out, however, that the proportion of production allowed the oil payment owner (70 per cent in the example shown in Table V) should be so limited that the remaining production retained by the operator (30 per cent in this case) will be sufficient to provide the latter with ample funds to continue the operation and development of the property. As production declines, the proceeds retained by the operator may approach the cost of operation. During the term of the oil payment, the operator's profits will be quite small and his real inducement is to pay off the oil payment so that he will become entitled to the entire production from the property. The owner of the oil payment must look to the operator to continue operations until the oil payment has been satisfied. The bank financing the oil payment must also depend upon the operator continuing operations, although the bank deals only with the owner of the oil payment and has no recourse to the operator. Hence, from the standpoint of the lender, it is wise and reasonable to require that:

1. The operator, being the owner of the residual, covenant with the oil payment owner to continue operations until the oil payment shall have been paid off.
2. The owner of the oil payment, that is, the borrower from the bank, have assets of consequence in addition to the oil payment, to which the bank may have recourse.

The lender will require that the operator of the property should be capable and reliable, whether a loan be made direct on the property or by the oil payment procedure. But because the loan ratio in the case of an oil payment may be higher than by direct loan, it is good business from the standpoint of the lender on the oil payment to require the above two qualifications and any other conditions which under the particular circumstances of the oil payment loan will assure its safety.

CONCLUSIONS

So far as the value of a property and the loan ratio thereon can be used as one of the criteria for judging the goodness of a loan, no hard and fast rule can be or should be set up. For properties that are exceedingly long-lived and whose reservoir conditions are such that great confidence can be placed in the estimate of reserves and operating costs, it is obvious that the loan ratio may be relatively high with equal safety. The same applies to natural gas producing properties with a 20-year take-or-pay sales contract. But where the production of the property is expected to decline rapidly or where the estimate of oil reserves cannot be relied upon with full confidence, the loan ratio should be lower. It all depends upon the particular property and circumstances.

The objective is to avoid unsafe loans. And the real test should *not* be whether the loan and the property can qualify under previously specified ratios — but: Is it a good loan under all the particular circumstances? That takes experience and judgment.

ACKNOWLEDGMENT

The authors are indebted to Loran E. Skousen, their associate in the Petroleum Department, The Chase National Bank, for his assistance in the preparation of the tables.

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4. Terry, Lyon F.: "The Valuation of Oil and Natural Gas Properties as Distinguished from Mines," AIME *Mining and Metallurgy*, (May, 1940) 227.
5. Muskat, Morris: *Physical Principles of Oil Production*, McGraw-Hill Book Co., Inc., New York, (1949) 414.
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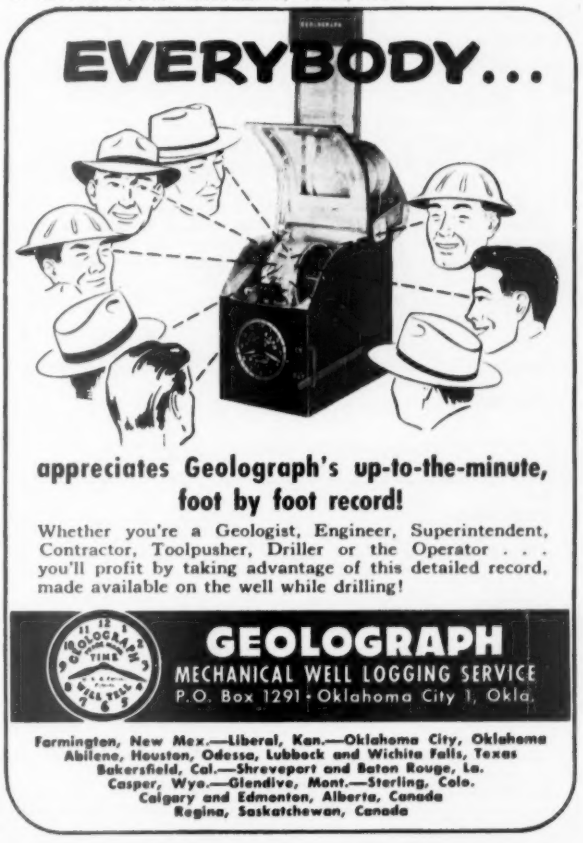

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Replies to the positions coded Y8555 and T9859 below should be addressed to: Engineering Societies Personnel Service, 8 West 40th St., New York 18, N. Y. The ESPS, on whose behalf these notices are published here, collects a fee from applicants actually placed.

PERSONNEL

♦ Sales engineer, petroleum engineering graduate Texas A&M in 1940, with four years as sales engineer of highly specialized oil field equipment, over seven years with one company. Looking for opportunity with major equipment manufacturer or distributor of basic products. Prefer location in Southwest but all offers considered. Code 196.

♦ Reservoir evaluation engineer for major oil company, 34, single, BS degree in petroleum engineering, with 7 years' experience in office and field work, desires to relocate as reservoir evaluation engineer with an independent. Code 197.

POSITIONS

♦ Junior geologist with degree, single status, for petroleum exploration. Must pass foreign service physical test and be draft exempt. Salary, $4,740 a year, plus subsistence and bonus. Location, Colombia or Venezuela. Y8455.

♦ Equipment specification engineers capable of writing specifications for all equipment used in all types of oil refineries, interpreting customer's specifications and checking supplier's prints. Prefer some experience in oil refinery work. Should have mechanical engineering degree, but not essential. Location, Ohio. Y8509.

♦ Sales engineer, 35-45, mechanical, petroleum, or chemical background. Must have had sales engineering experiesce with oil and chemical account. Will handle the New York office, take care of office work, follow-up work and occasional travel. Salary, plus commission. Y8812.

HAVE YOU CHANGED YOUR ADDRESS?

In order that publications and correspondence may reach you promptly, the Petroleum Branch, AIME, should be advised as soon as possible of any change in your address, *preferably a month before the change becomes effective.* For the AIME directory and for the Personals column of the JOURNAL OF PETROLEUM TECHNOLOGY, additional information is desired. The form below is provided for your convenience, and should be sent to Petroleum Branch, AIME, 800 Fidelity Union Bldg., Dallas 1, Tex.

Name_____ Membership No._____

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List below your former title or company position, nature of your new position, or other information of interest to your associates for publication in the JOURNAL OF PETROLEUM TECHNOLOGY.

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One month normally required for change of address.

New Basis Adopted For Life Memberships

By paying 20 times the current annual fee, a Member or Associate Member of the Institute can become a Life Member. This was provided by a revision of Art. II, Sec. 3, of the AIME Bylaws passed by the Board at its May meeting. Heretofore the fee had been fixed at $300 when the dues were $15. The repised bylaw now reads as follows:

"Any Member or Associate Member may become, by payment at one time of 20 times the current normal annual dues for the grade in which he is enrolled, a Life Member or Life Associate Member, according to his current status at the time application is made."

★ ★ ★

Proposed for Membership Petroleum Branch

Total AIME membership on Mar. 31, 1953, was 18,475; in addition 1,098 Student Associates were enrolled.

PETROLEUM BRANCH ADMISSIONS COMMITTEE

J. H. Sullivan, Chairman; Thomas S. Bacon, Vice-Chairman; A. E. Caraway, Frank C. Kelton, Thomas E. Morton, and F. C. Prutzman.

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The Institute desires to extend its privileges to every person to whom it can be of service, but does not desire as members persons who are unqualified. Institute members are urged to review this list as soon as possible and immediately to inform the Secretary's office if names of people are found who are known to be unqualified for AIME membership.

In the following list C/S means change of status; R, reinstatement; M, Member; J, Junior Member; A, Associate Member; S, Student Associate.

CALIFORNIA
Glendale — Lakey, Charles Jack (J).
Pasadena — Sheppard, James Carroll, III (J).
Taft — Williams, Leon (J).
Torrance — Green, Laurence Andrew (J).

LOUISIANA
Harvey — Ferguson, Arnold Dewey, Jr. (M).

MISSISSIPPI
Brookhaven — Justus, Joe Bob (R, C/S-S-J).
Hattiesburg — Foster, Jack Emmett (J).
Laurel — Oliver, Richard D. (J).

NEW YORK
Flushing — Smith, Ashleigh William (J).

OKLAHOMA
Tulsa — Nelson, Roy Andrew (M).

PENNSYLVANIA
Hazelton — Klotz, Robert Lauback, Jr. (M).

TEXAS
Abilene — Moore, Earl Kenneth (J).
Bellaire — Greer, Cecil Bird (M); Whitis, Emett Duwain (R, A).
Corpus Christi — Lotspeich, Harry Lee (J); Seidel, Herbert Arthur, Jr. (J).
Dallas — Koch, Robert Louis (M); Peers, Harry L. (A); Wessely, Arthur Jourdan (J).
Fort Stockton — Dimon, Alfred Floyd (R, C/S-S-J).
Fort Worth — Rowan, Archibald Hamilton, Jr. (J).
Midland — Schmalz, Julius Paul (R, M); Sheehan, John Allan (M).
San Antonio — Kline, Loren E., Jr. (R, C/S-J-M).

BOLIVIA
Camiri — Mauri Willanueva, Enrique Tomas (M).

BRITISH GUIANA
Mackenzie — Davison, Henry Asquith (M).

CANADA
Calgary — Hakim, Khalifa Arif (J).

VENEZUELA
Caracas — Wise, Richard Atlee (M).

Valuation of Gas Property

(Continued from Page 13, Section 1)

even necessarily approximate valuations for rate purposes or values as indicated by the securities markets.

CONCLUSION

It is apparent that the appraiser makes many decisions in his analysis, based on his skill, his technical knowledge of geology and engineering, and his familiarity with the economic realities which affect the value of a natural gas property. He makes his studies and reaches his conclusions on the basis of the best information available. His final determination of the fair value is conditioned by all of the pertinent facts. If he is conscientious and informed, then the value reached will command respect, and will not be dependent upon "flights of the imagination" which Mr. Hoover deplored.

ACKNOWLEDGMENTS

The authors wish to express their appreciation for the help of John S. Ivy, J. Milton Wege, and Francis S. Yeager, of Houston, Tex.

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(Continued from Page 30, Section 1)

issues in a free market undoubtedly would have sold at substantial discounts; and such estimated discounted figures were used in arriving at the proportion of total market value of the company to be allocated to the small common-stock issue.

The indicated aggregate value of the common was determined to be $12,000,000. Since the number of shares involved in the question put to us would have resulted in a very limited and inadequate market, an adjustment of 20 per cent was made for this factor. Selling costs involved in a public underwriting were deducted to arrive at a final value per share to the seller. It was also determined that realization to the seller would have been somewhat less by a private placement than by a public underwriting.

It should be apparent from this short description that judgmen based on a "feel" of the situation was an important factor in the decision.

CONCLUSIONS

Issues cannot be selected either for investment or speculation by the use of valuation reports alone. We would be guilty of a great disservice, however, if we permitted anyone to infer that because they cannot do the complete job in one operation, their aid to the investor is limited. Our experience indicates just the opposite. A valuation report properly prepared and correctly used can help the investor more than any single thing. The biggest problem with which the oil analyst is confronted is getting accurate basic information. A valuation report gives such basic information so that the analyst knows what a company is and what it isn't. With this background he can begin to study managerial policies and determine managerial effectiveness. Only through detailed understanding of the factual side of a company and its management can an opinion be formulated of the direction in which it is headed, and the likelihood of its achieving success. An investor, to be comfortable with a company of his choosing, must know well the economic forces that cause the blood stream to course through its corporate veins. A valuation report contributes immeasurably to this understanding.

Geology is a science which is most effective in the hands of an individual with a special touch in using it to locate oil. Perhaps investing is less of a science than geology, but it is equally as much an art in its application. Both have one important similarity on the human side. The geologist and the investor are said to be smart when they make the right decisions for the wrong reasons. ★ ★ ★

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Turnbull Joins Independent Operators, Replaced By Justice at La Gloria

Paul R. Turnbull, 1952 chairman of the Petroleum Branch, AIME, has resigned his position as drilling and production manager with La Gloria Corporation in Corpus Christi, Tex., to join B. F. Vaughan, Jr., and Frank P. Zoch, Jr., effective July 1 as independent oil operators. They will be located in the Wilson Tower Bldg. in Corpus Christi. William H. Justice, technical adviser for La Gloria, will replace Turnbull as drilling and production manager.

TURNBULL

From August, 1946, until September, 1949, Turnbull was division petroleum engineer of Humble's Southwest Texas Division in Corpus Christi, and in mid-1949 he became manager of the drilling and production departments for La Gloria Corp.

Active in the AIME for 15 years, he was vice chairman of the Production Technology Committee (now Technology Committee), which has as its main duty the responsibility of arranging for sufficient technical papers to be presented at various Petroleum Branch meetings. That same year he acted for the chairman of the Branch in arranging a program for the Branch in San Antonio, Tex. During 1951 he served as Branch vice-chairman, and was unanimously accepted as Petroleum Branch Chairman for the year of 1952.

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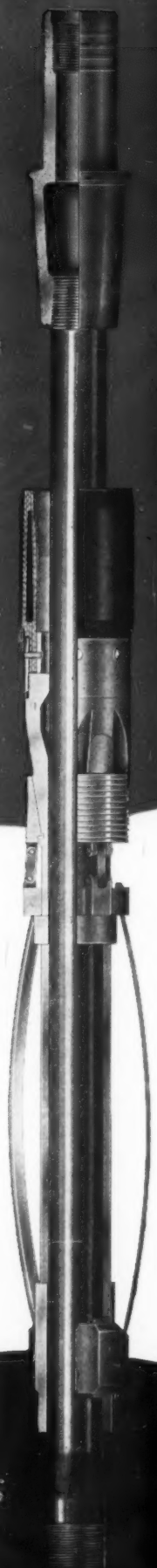

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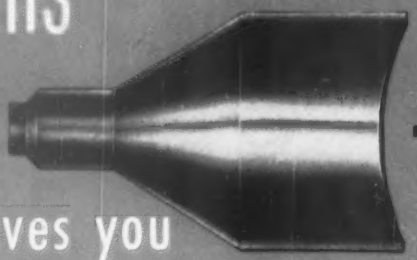

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